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爪哇 ボゴル 植物園

HORTUS BOTANICUS BOGORIENSIS, JAVA

動物學彙報

第一卷：第一號

昭和十九年三月

軍政監部産業部



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發 刊 ノ 辭

本彙報ハ大正八年一月ヨリボゴル植物園動物博物館並ニ動物研究室ノ機關雜誌トシテ發行シ來レル *Treubia* ト性質ヲ同フスルモノニシテ今般改名シテ之ヲ續刊スルコトトナレリ

皇軍ノジャワ占有後其庇護ノ下ニ蘭人學者ガ安全ニ其研究ヲ續ケテ此等ノ論文ヲ完成シ茲ニ軍政監ノ許可ヲ得テ之ヲ世界ニ公表シ得タルハ實ニ聖代ノ慶事ト謂フベシ、敵國ガ徒ニ在住同胞ヲ虐待スルコトニノミ狂奔シアル際我軍政下ニアリテハ敵國人ガ其技倆學オヲ尊重サレテ邦人同様ノ支給ヲ受ケ平時ノ如ク研究ニ從事シ居ルヲ知ラバ米英ハ宜シク自ラヲ顧ミテ其鬼畜ノ行爲ヲ改ムベキナリ、茲ニ別紙蘭人ノ感謝文ヲ添ヘテ卷頭ノ辭トナス

昭和十八年六月

ボゴル植物園長

中井猛之進

The Keeper of the Zoological Museum and the Laboratory for Scientific Zoological Research herewith begs to acknowledge his gratitude for the generosity of the Japanese Army, which enabled the publication of this volume of Treubia under circumstances, normally disastrous to Scientific work.

W. GROENEVELDT

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論 文 摘 要

レーメント：蜂類 *Anthophora* 屬 *zonata* 群ノ新特徴ニヨル再調査

Zonata (有條) 群ノ名ハリネウス氏ノ命名セル青キ輪紋ノアル東印度産野生蜂ニ基ク、其後多數ノ種ガ發見サルルニ及ビ從來ノ檢定ハ色彩ノミニ依リシ爲メ檢定ニ困難ヲ感ズルニ至レリ、大凡昆蟲類ハ生殖器官ノ相違ニテ分類サルルモ本群ニテハ生殖器官ガ皆同型ニシテ是亦分類上ノ標徴トナラズ、種々研究ノ結果腹部腹面及ビ背面ノ殻皮及ビ雄ノ尾端ニアル雌愛撫器ノ形狀ニ系統上ノ特徴ガ最モヨク現ハレ居ルコトヲ發見シ此ニヨリテ新分類ヲ試ミタリ、尙ホ營巢ノ狀況其他蜂ノ習性ニツキ興味アル事實ヲ記述セリ。

ヂヤコノツフ：西部ニューギニア、ウ井ツセル湖産小蛾類

此論文ハ西部ニューギニアノ中部ニテ昭和十三年 *van Eechoud* 採集品ト同十四年ルルー探檢隊ニ參加セル *Boschma* 教授採集品ノ中ニアル小蛾類中 *Tortricidae* 科ニ就テ研究セル結果ヲ記シタルモノナリ、採集地ハ海拔六千呎ノ密林ニ被ハレタル斜面ト沼狀ノ溪谷トナリ、本編ニ記スモノノ中ニハ新屬一、新種十一アリ、其標本ハ皆ボゴル植物園ノ動物博物館ニ藏シアリ、此研究ニヨリ現地ノ昆蟲ハ高山性ト低地性又ハ海岸性ノモノトノ混合ナルコトヲ確メタリ。

リーフチング：インドネシア産 *Anthophoridae* 科ノ蜂類

レーメント氏ノナセル研究ト同ジク從來用ヒタル色彩ハ時ヲ過ルニ從ヒテ褪色シモハ脱落スル故雄性生殖器及ビ腹面先端殻皮ノ形狀ニヨル分類法ガ此蜂類ヲヨリ正確ニ分類シ得ルモ尙ホ其習性ハ分類學上見遁スベカラザル特徴ナルコトヲ確メタリ、即チ *Anthophorides* 類中森林ニ棲ム珍種ハ限ラレタル花ヨリ花蜜ヲ吸收スルヲ以テ原生林ニ生ズル植物中何種ノ花ニハ何種ノ蜂ノミガ來リテ花粉ノ媒介ヲナスカヲ確メ得ル日アルヲ豫言セリ、尙ホ *Anthophorides* 類ノ口吻ノ長キコトハ長キ花筒ヲ有スル花ヨリ花蜜ヲ吸收スルニ適スル所以ヲ斷言セリ、圖版多數ガ挿入シアリ。

トクソペウス：ニューギニア雪山産 *Delias* 屬ノ蝶類

本研究ニ用ヒシ材料ハ明治四十四年ニューギニアノ *Andreae* 河ノ上流 *Goliath* 山ノ西四十哩許ノ地ニテ *Dumas* ノ採集セル四種ノ蝶類ナリ、右ノ中三種ハ既知種ニシテ一種ハ新亞種ナリ。

ドゥヨン：ジャカルタニテ最近孵化シタルコモド大トカケノ子

昭和十六年四月十五日ジャカルタ動物園ニテコモド大トカケノ子ガ孵化シタガ其親ハ昭和十二年六月 *Flores* 島ニテ捕ヘタルモノニテ何日ニ交尾シタルカ又ハ産卵ノ爲メニ穴ヲ掘リシカ何人モ氣附カザリシ事故俄然子ノ孵化ヲ見タルハ全ク意外ノ出來事ナリキ、本編ニテハ生レタル幼蟲ノ長サト形態ノ記事ヲ載ス、嘗テスーラバヤ動物園ノ實驗ニテコモド大トカケノ交尾期ハ七月、産卵期ハ八月ナルコトヲ知り居ル故ジャカルタニテ四月ニ孵化セルコトヨリ推測シテ卵ノ産卵ヨリ孵化迄ニハケ月ヲ要スルコトヲ推定シ得タリ。

トクソペウス： ジャワ新發見 *Actias selene* ノ雌

此材料ハボゴル動物博物館ノリーフチンク及ビ其夫人ガ東部ジャワノ山ヲ歩ク中藤ノ葉ニ附着セル蛹ヲ採集孵化シテ得タル *Actias selene* ノ雌ナリ、本種ハ從來日本、台灣、支那、東印度、錫蘭、アンダマン島、ボルネオヨリ即チ北半球ノミヨリ報告サレ居ル故、東部ジャワ産ハ實ニ本種ヲ南半球ニテ發見セル最初ノモノナリ。

フアンベムメル： *Cervus kuhlii* ノ分類學上ノ位置

鹿ノ一種 *Cervus kuhlii* ノ齒、角、頭蓋骨、毛及習性、臭氣分泌腺ノ研究ニヨリテ同種ハ *Cervus* 屬ニ非ズシテ *Axis* 屬ノ鹿ナルコトヲ斷定シ且ツ此鹿ガ前世期ノ遺物ナルコトヲ斷定セリ、化石ニノミ知レ居ル *Cervus oppenoorthii* モ亦 *Axis* 屬ニ移サルベキナリ。

トクソペウス： 第三回 Archbold ニューギニア探檢ノ結果、
鱗翅類中 *Riodinidae* 科

ニューギニアニハ *Riodinidae* 科ノ蝶ハ二屬 (*Sospita* 及ビ *Dicallaneura*) ニ屬シニューギニア本島及其附屬島嶼ニノミ棲ミ唯 *Sospita* 屬ノ一種ノミガ濠洲クインスラントノ北部ニモ分布ス、記載セル種數二十四ニシテ其中新亞種九アリ、此研究ニヨリ *Riodinidae* ノ如キ稀ナル蝶類ハ極メテ地方的分布ヲナスモノナルコトヲ確メタリ。

A CRITICAL REVISION OF SPECIES IN THE ZONATA GROUP OF
ANTHOPHORA BY NEW CHARACTERS

(Part I)

by

TARLTON RAYMENT

(Sandringham, V., Australia)

INTRODUCTION

It has been evident for many years that the practice of systematists in relying mainly on characters such as the pale face-marks, and the colour of the body-hair, for the separation of the species in the *zonata* group of *Anthophora*, has resulted in confusion in the identification of these beautiful bees.

The group owes its title to LINNAEUS, who bestowed the name on a distinctive Indian species, the black abdomen of which is conspicuously banded with iridescent blue hair. Since that time other species, of similar facies, and comprising a spectacular group, have been described by FABRICIUS (1804); LEPELETIER (1841); DOURS (1869); SICHEL (1869); SMITH (1879); MEADE-WALDO (1914); COCKERELL (1931) and RAYMENT (1939). Each of these authors used the ivory-coloured or yellow face-marks, together with the colour of the body-hair, as characters for the separation of the species (text fig. I, fig. 1 and text fig. II, fig. 5).

For several years the author has been receiving collections of *Anthophorae* from correspondents scattered over the five States — no specimens came from either Tasmania or New Zealand — and, as the numbers grew, it became apparent that the most obvious character, colour, lost its importance — it is always unsatisfactory depending, as it does, wholly on light. Moreover, the difficulty of describing colours in exact terms adds to the difficulties of the student. Accurate identification from the descriptions was no longer possible, for they are not illustrated with effective drawings of critical characters.

CONFUSION OF THE AUTHORS

The position was aggravated by uncertainty in the literature. DOURS gave the length of 18 mm for *cineta* — which he thought, erroneously, to

be *Megilla cingulata* FAB. — and SMITH and COCKERELL agreed that DOURS's figure must have been a misprint for 13 mm, since both had bees of that size conforming otherwise to the Doursian description. But neither of these systematists had DOURS's bee, which I was fortunate enough to receive from the Hunter river in New South Wales.

MEADE-WALDO, at the British Museum, informed COCKERELL that he had examined SMITH's type of *emendata*, and found it to be the true *cingulata*; but MEADE-WALDO could not determine that on the characters available at the time. However, he pointed out that the type was a male, and not a female, as stated in SMITH's description.

Later, COCKERELL published his keys, and added this note — "*Anthophora zonata* L., widely distributed in Queensland, and extending to Adelaide, S. A., and W. Australia. A colour variation has been referred to as *A. zonata subcaerulea*, but it appears not to be the genuine (Asiatic) *A. subcaerulea* of LEPELETIER. — It is possible that more intensive studies may indicate the separation of the Australian insect from *A. zonata*, in which case it will take the name *A. pulchra* SMITH."

This research demonstrated that neither of the Indian bees is found in Australia, therefore, SMITH's *pulchra* is a valid species, and others, such as *thorogoodi*, *perpulchra*, *pulchra* and *parapulchra* have been determined hitherto as *zonata*, and this is true of many species in the Malay Archipelago.

COCKERELL said further: — "*A. chlorocyanea* was formerly mistaken for *A. cingulata*." But COCKERELL was doubtful of a few of his own species, for he appended the following footnote: —

"Since writing the above, I have examined two pairs of *Anthophora* sent by F. ERASMUS WILSON, and I find there are complications yet to be dealt with. They came from Redcliffs, Victoria (L. H. CHANDLER), and Blackall, Queensland (C. BORCH). In both males the clypeus is broad above, the straight upper margin of the yellow much longer than the distance from its ends to the orbits. In a male *A. zonata* from Thursday Island, the upper edge of the yellow is much shorter than the distance from the ends to the orbits. I am calling all Mr. WILSON's specimens *A. zonata*, but I feel now that the value and significance of the names, *zonata*, *pulchra*, *asserta* need reconsideration, and would urge Australian students to dissect specimens from as many localities as possible."

In January, 1940, Mr. M. A. LIEFTINCK, of Buitenzorg, Java, wrote to the author: —

"I fear that many identifications, even of common species inhabiting the great Archipelago, must remain provisional or doubtful, and numbers of oriental *Apidae*, described as new, may prove to be some of SMITH's old species. For the present, it would seem to be of the utmost interest to find out just how many species there really are".

DOVER (1924) studied the species in the collection of the British Museum and, on examining the genitalia, found so little of taxonomic worth he concluded that all the bees were merely subspecies of *zonata*; a decision that made confusion more confounded. However, he regretted that the number of specimens available for study was so small. He saw some slight value in the form of the minute seventh and eighth sternites which, in combination, form the titillatum, but he did not study these critically, nor did he examine the apical plates of the male and female abdomen, and so missed the only decisive characters.

DOVER's speculations on the relationships of the group are worthless, for this research demonstrates the undoubted connexion of *pulchra*, *zonata* and *pulpulchra* to *cingulata*, *elegans* and *lieftinckiella*. The *chlorocyanea* tribe is distinct, but is connected by *murrayensis*, which has the lateral face-marks of the *pulchra* tribe, and the serrated process of the seventh sternite of the *chlorocyanea* tribe.

It will be seen that species like *luteola* are farthest from *pulchra*, as shown by the eighth sternite, which is quite different, so they form a distinct tribe, with *murrayensis* as the link. It will be noted, too, that forms of *cingulata*, from MacIntosh Holding, Q., have a white floccus on the hind legs, and definitely link it with *pulchra*.

It is evident from the foregoing that the need for a revision was urgent and, since the author had already received from several authorities numbers of blue-banded bees labelled „*zonata*”, but all of which proved on dissection to be very different from the Indian species, he determined to make a critical revision of the group ¹⁾.

COLLECTION OF MATERIAL

The author personally had collected from many widely separated localities several hundred *Anthophorae*, and also possessed the cells of five species, and had closely observed their "nesting" habits. In addition, he was familiar with the collections in the Museums of the capital cities, but felt that much more material was required to ensure a satisfactory revision.

In the endeavour to obtain additional specimens from as many other localities as possible, the author adopted the unusual course of invoking the aid of two popular magazines, "Walkabout", and "Wild Life", in an appeal to nature-lovers to help with the gathering of the material. The response exceeded the most sanguine expectations, and the success of the appeal undoubtedly was due to the courtesy of the editors in forwarding the replies, and the publicity which they gave so freely to the native bees.

¹⁾ This research was assisted by a small grant from the Trustees of the Commonwealth Science and Industry Endowment Fund.

A killing-bottle, labels, and a container were forwarded by post to each approved volunteer, who also received a type-written sheet of instructions, based on the field-experience of the author, and the habits of the bees.

The author, therefore, expresses his sincere thanks to the editors, and the large number of their readers who assisted so conscientiously in the work, and to whom he is indebted for several hundred specimens. The names of these collectors, together with their districts, appear under the several species and it will be noted that the five states are well represented.

It was essential that topotypes of *A. zonata* L. be dissected in the search for microscopical characters, since the gross morphology presented so little of real value to the taxonomist, and specimens of these were made available through the good offices of the Imperial Entomologist, Doctor H. W. POULTON, New Delhi, India. A splendid series was received from Mr. M. A. LIEFTINCK, Zoologisch Museum, Buitenzorg, Java, and specimens from Celebes came from Doctor VAN DER VECHT, Buitenzorg, Java; males from Formosa came through Doctor RHEINHOLD MEYER, Darmstadt, Germany, and specimens were loaned by the Perth, Sydney, Brisbane, Adelaide and Melbourne Museums.

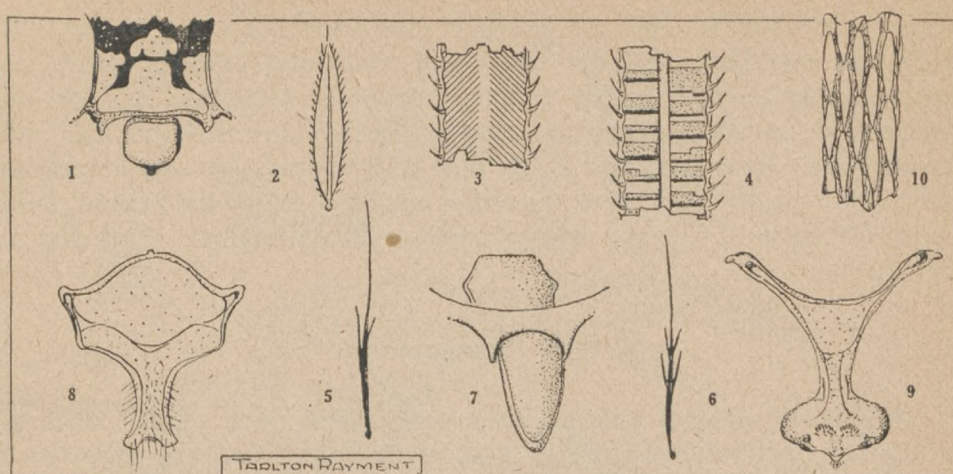
It was considered advisable to record the names of flowers frequented by the *Anthophorae*, and plant specimens — often fragmentary after a long journey in excessive heat — were referred to the National Herbarium, Melbourne, for identification. The author desires to thank the several authorities for the courtesies extended to him.

Genus *Anthophora* LATREILLE

Hist. Nat. Cr. et Ins., xiv, p. 45, 1809.

The bees are widely distributed over Europe, Asia, Africa, America and Australia. Several of the earliest species were described as *Podalirius* and *Megilla*, but all are thick-set, "cobby" bees, well-covered with a fleece of plumose hair, and bearing on the „face" pale-yellow marks that show clear through the tegument (text fig. I, fig. 1). The taxonomic position seems clear until the *zonata* group is reached and then, as Professor COCKERELL has remarked, the classification becomes extremely difficult.

The gross morphology seemed to offer so little to the systematist; the clypeus lacks structural peculiarities such as one finds in *Megachile*; the stout legs have none of the grotesque forms of *Nomia* and *Gonicolletes*; the metathorax is devoid of the rugae so helpful in the determination of *Halictus* and *Andrena*; the calcariae are simple, and offer nothing comparable with the dentate spurs of *Paracolletes*, *Halictus* and *Euryglossa*; the antennae, too, are short and simple, and there are no dilated scapes as in *Meroglossa* and *Neopasiphae*; no lamelliform or



Text fig. I. *Anthophora*, various structures. Fig. 1. Inside view of clypeus and labrum of *Anthophora flammeozonata* DOURS; 2, A scale hair from abdominal fascia; 3, The scales are diagonally striate; 4, Colours of scale by reflected light: white = pale green; dots = cerise; black = deep purple; 5 and 6, Long forked hairs from mesothorax; 7, Apical plates of ♂ and ♀ *Anthophora*; 8 and 9, Seventh and eighth sternites of a variety of *A. pulchra*; 10, Imbricated pattern formed on glossa by spatulate hairs.

spatulate flagellum as in *Cladocerapis* and *Thaumatossoma*; the abdomen and postscutellum are minus the nodes and spines of *Osiris* and other genera; the mandibulae are not helpful, as in *Gnathoprosopis* and *Megachile*; the neuration of the wings is singularly constant, and there is no distinctive appendage to the labrum as in *Halictus*.

The dense plumose fleece of the thorax usually contains numerous long, strong, forked, black hairs (text fig. I, fig. 5-6), and these have a definite influence on the general aspect of the colour; intermixed with fulvous or orange the effect is dull-brown; with blue or white, a drab-grey; with green a dark-russet. Though the black hairs, too, are striate like the scales, yet they are pigmented, and absorbing the light, appear black from all angles.

The blue fasciae of the abdomen are formed of flat, leaf-like scales or hairs exhibiting a wide range of tints according to the incidence of the light (text fig. I, fig. 2-4). They may appear emerald-green, but a slight movement changes them instantly to electric-blue; this is very marked in *gilberti* and *emendata*. In *salteri*, *vigilans* and *adelaidae* golden reflections prevail, while in *parapulchra*, *perpulchra*, *walkeri* and *pulchra* there are no golden or greenish tints, but blue and silver; others have a mother-o'-pearl, and even lilac hues, as in *lilacina*; some appear to be merely dull-white, as in *murrayensis*, but even these show mother-o'-pearl reflections; *chlorocyanea* exhibits emerald-green and blue, not only on the abdominal fasciae, but also on the hair of the legs.

Examined with a 1/6 inch objective the scales exhibit a diagonally

striate surface which refracts the light-rays (text fig. I, fig. 3), so that each scale scintillates with the "fire" and colour of a brilliant opal. That the remarkable colour-display is due entirely to refraction, and not to pigment, is proved by mounting a few scales in water or turpentine, and viewing them by transmitted light; they then appear clear and colourless (text fig. I, fig. 2). In *lilacina* the scales exhibit a royal-blue ground, with bands of cerise of varying widths edged with dark-purple (text fig. I, fig. 4).

NEW CHARACTERS

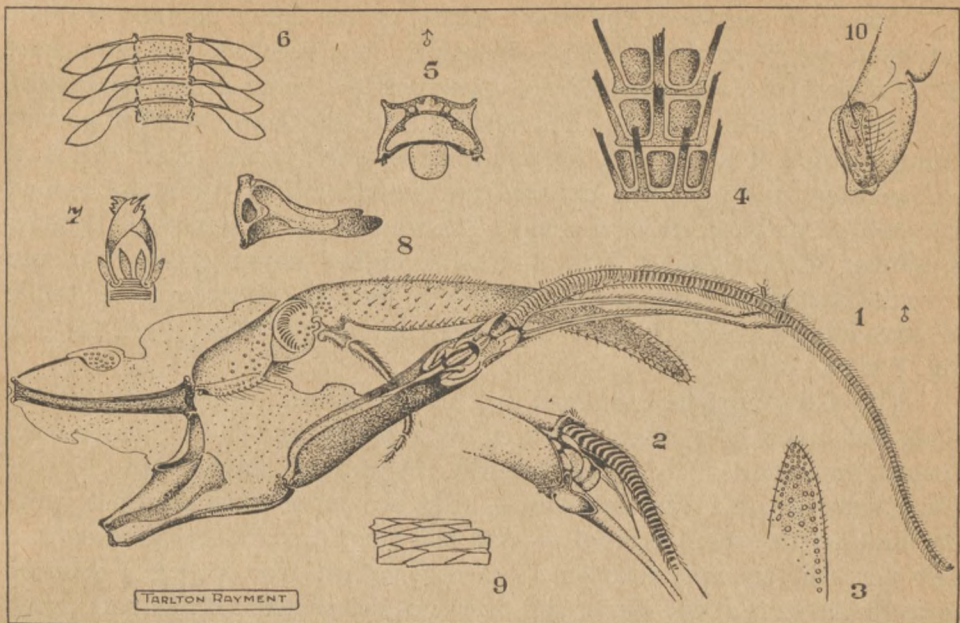
The scales are not alike on all species; some have simple margins, others are finely serrated, while those of *flammeozonata* are edged with long strong spines. It would seem, then, that the form of the scale has some little value as a specific character.

Faced with this rather barren situation, the author decided to dissect systematically a very large number of bees, and prepare mounts of certain portions of the anatomy for microscopical study. The mouth-parts were investigated first, but yielded little, except the fact that the manner in which these complicated organs function has not yet been satisfactorily explained. It might be noted here that the glossa in this group is extremely attenuated, and around each of the numerous segments several leaf-like hairs are arranged in peculiar order (text fig. II, fig. 4 & 6).

Professor COCKERELL measured the length of the glossal spatulate hairs of *A. darwini*, and found them to be $220\ \mu$ long, with a width of $30\ \mu$ and the author finds the length and width of those of several other species to be within a few microns of COCKERELL's figures. His description of the comb on the second segment of the maxillary palpus has no specific value, since many species exhibit similar spines.

In death, the spatulate hairs stand out at right angles to the glossa, and mislead the observer as to their true position (text fig. II, fig. 6), but in life the thin plates completely enclose the glossa by forming a kind of imbricated tube, on the outside of which are thousands of pollen-grains, as though the liquid nectar has been filtered as it passed through the hundreds of slits of the imbrication (text fig. I, fig. 10). The author greatly regretted that no funds were available to permit an investigation into the physiology of the Anthophorid tongue, since that of the honey-bee is not yet clearly understood.

The knee-plate, patella, of the females offers some possibilities, but these are often masked by luxuriant tufts of hair, and must be examined dry, since much of the surface structure becomes invisible when wetted. The knee-plates were abandoned as the research progressed and better characters became available. It was found eventually that the decisive



Text fig. II. Mouth-parts of *A. zonata*, ♂. Fig 1, Lateral view of mouth-parts (one maxilla not included); 2, Base of glossa and labial palpus attached to mentum; 3, Extreme tip of galea has numerous pores; 4, Three segments of glossa showing disposition of the spatulate hairs; 5, Clypeus and labrum; 6, The segments of another glossa showing the spatulate hairs; 7, The tip of the glossa has no "spoon"-shaped labellum like the hive-bee; 8, Mandible, inside view; 9, Sculpture of the mentum and galea; 10, Extreme base of maxilla.

characters in this group lie in the apex of the abdomen; the fifth and sixth sternites are also helpful.

It was found too, that the sternites have a good specific character in the line of demarcation separating the exposed hirsute area from the clear smooth hairless basal margins covered by the apodemes of the adjacent plates (text fig. IV). In several species, such as *cingulata* and *perpulchra*, it will be observed that the margins are suffused with black (text fig. IV), but *korotonensis* is remarkable in having the exposed area darker than the margin.

The seventh tergite of the males is produced to a red chitinous plate with two more or less sharp teeth, those of *asserta* being 100 μ long on the inner, and 300 μ on the outer side, with a measurement of 500 μ between the apices (text fig. I, fig. 7). A critical study of the form of the seventh tergite revealed its value to taxonomy.

The genitalia, too, were examined intensively, and while the general contours have some slight value, better characters are found in the apices of the stipites, and the titillatum — formed of the seventh and eighth plates of the abdomen — which undoubtedly has an exciting function as it "pats" the female during coition (text fig. I, fig. 8-9 and text fig. III, fig. 1-5).

The sixth tergite of the female bears, on the dorsal surface, a small, elongate, red plate about $1020\ \mu$ in length; it is not flat, but often bent down almost at a right angle; the upper portion, being nearly horizontal, is covered normally by the fifth tergite, only the lower vertical portion being exposed (text fig. III, fig. 2). Unexpectedly, it was discovered that the greatest width of the exposed part conforms to the measurement between the apical teeth of the male. The surface of the female plate bears a number of striae, about fifty, and under higher magnification it is seen that the surface is formed very similarly to that of a tiled roof, the striate effect being produced by the thick lower edge of the "tiles" (text fig. III, fig. 7 a-b).

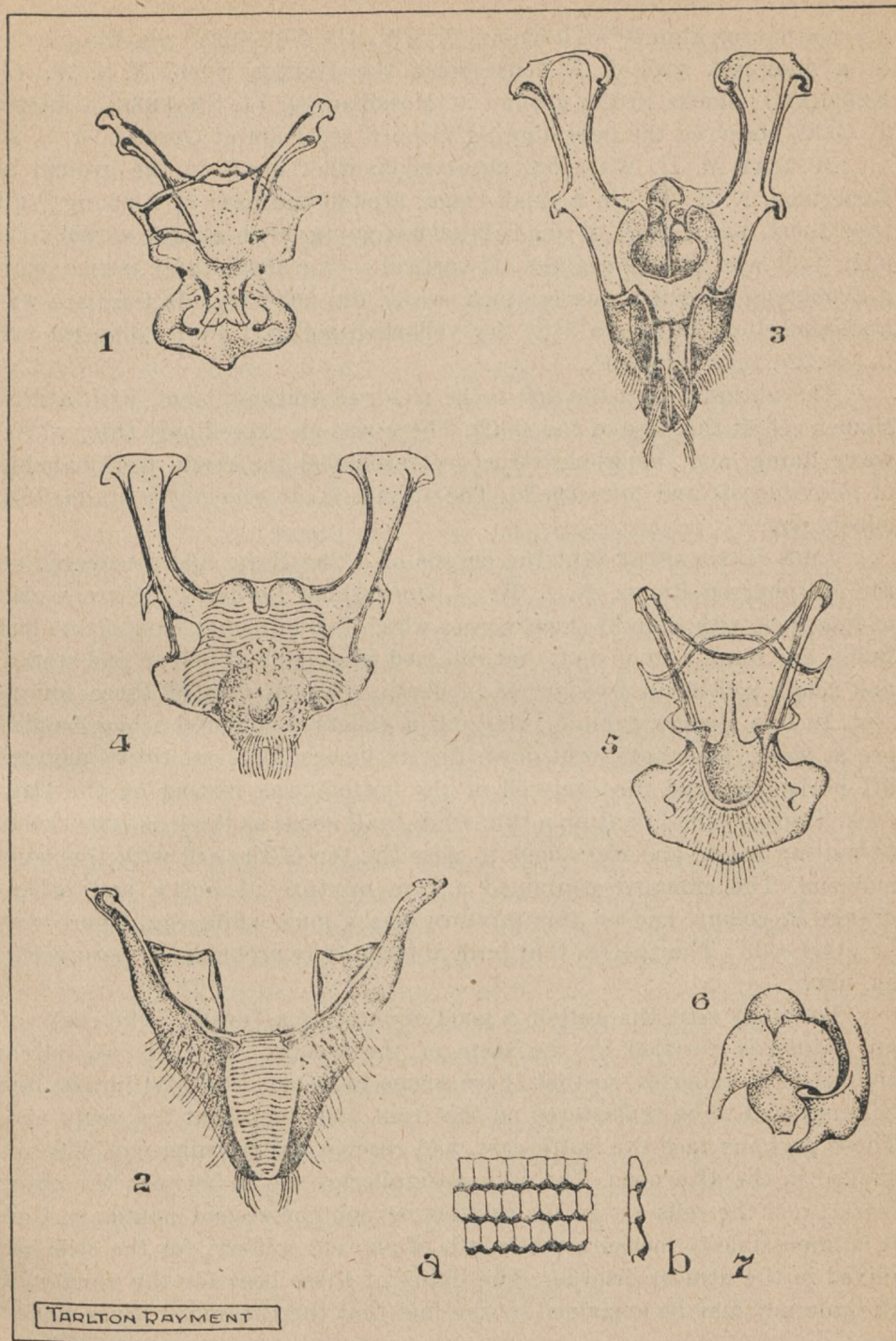
The plate must be examined dry for the striate structure to be studied, but since it is often obscured with pollen and honey, earth, and sometimes a snow-white waxy material, the author's method is to remove the apical segments after relaxing — they are, more often than not, quite dry and brittle when received — and boil them for fifteen minutes in a five per cent aqueous solution of caustic potash. Too strong a solution impairs the skin of the plate, and destroys the pattern. When soft, wash well in water to remove the potash, and dehydrate in alcohol. At this stage make dry mounts of the female plates (text fig. III, fig. 2).

Rarely, the student will find the apical plate of the females bidentate, but of the several hundred bees examined, only three exhibited this peculiar structure, but in *emendata* it is conspicuously formed, and at once separates this bee from the closely allied *gilberti* (see specific description).

SITE OF THE NEST

American and European naturalists agree that the young *Anthophorae* of those continents build their new cells adjacent to their natal cradles so that, in the course of years, large colonies are formed. Only two nests of Australian *Anthophorae* have been observed closely over a long period, one at Gunbower, V., and the other at Lismore, N.S.W. The Victorian "nest" has been under observation for nearly eight successive years; the other is known to have been occupied continuously for more than twenty-six years, which is by far the longest period recorded in the literature of the genus. Both these colonies are still populous and vigorous.

Only ten "nests" are known in Australia; in the mud-brick chimney of a farmhouse on Gunbower Island, V. (T. RAYMENT and E. FERRIS) where the aspect is a northern one; in the sandstone sea-cliffs at Bronte, N.S.W., where the aspect is eastern (T. RAYMENT and P. WHITELEY); in the mortar of a terra-cotta brick wall at Marrickville, N.S.W. (P. WHITELEY); in the reconstructed mud "nest" of a wasp built on a fence-rail at Proserpine, Q. (T. RAYMENT and H. THOROGOOD); in the mortar of



Text fig. III. Apical segments of *Anthophorae*. Fig. 1, Titillatum, 7th and 8th sternite of ♂ *A. salteri*; 2, Apical dorsal segment of ♀ *A. fabriciana*; 3, Apical ventral segment by transmitted light; 4, Apical ventral segment of ♀ *A. gilberti*; 5, Titillatum of ♂ *A. chlorocyanea*; 6, Showing how the penis is connected with the claspers; 7, Surface of the apical plate (a), cross-section to show the tile-like sculpture (b) in *A. lateola*.

a brick house-chimney at Lismore, N.S.W. (D. TOWNLEY); in the plaster of a mudbrick wall of a house near the Hunter river, N. S. W. (J. KERSHAW); shafts in the ground at Mossman, Q. (J. SHAFFERY). JAMES T. GRAY observed the bees digging in hard red loam at Orroroo¹), S. A.

MURRAY M. H. WALLACE observed another shaft in the ground at Robertson, N. S. W. „In a small ridge, around the base of a young fruit tree, there was a shaft of an *Anthophora* going down almost perpendicularly — it was only 10 degrees off vertical — for about three inches, with a diameter of about a quarter inch, which did not vary. At the base was a single cell containing a little dry yellowish pollen. I am sending the cell to you for investigation”.

The author found the soil to be rich red volcanic loam, with a misshapen cell at the base of the shaft. There was an exceedingly thin, white, waxy lining, and the whole structure resembled the crude workmanship of *murrayensis* and *townleyella*. The species is *A. perpulchra wallaciella*, subsp. nov.

JOHN HARDCASTLE sent the details of a "nest" he had discovered on the Macpherson Range, N. S. W. — Queensland Border. "Picture a slab of flag-rock with a slight slope, across which two branches from a tree had fallen, and made a small dam that retained fragments of leaves, and stones, and rough soil about two inches in depth, over an area of three square feet. In this shallow ground I dug out a gallery and found a blue-banded bee at work. The shaft went down for six inches, at about thirty degrees off horizontal, and the oval cell at the bottom was resting on the flag-rock. There she had built up a thin white wall about as thick as four sheets of writing paper, and was about to close the top of the cell with the same material. The chamber contained a thin mixture of honey and pollen, orange in colour, and on this mixture was a long white egg. There was no other cell". The species that built this shaft is probably *A. perasserta*, sp. nov.

TOWNLEY sent the author a good account of a "nest". "The claim of my father is verified by the state of the mortar, for it is absolutely riddled with galleries, so that there seems to be no lime left; indeed, the chimney had to be replastered on the front and side about ten years ago. These portions face the south-east, and receive the morning sun, but are shaded in the afternoon. The entrance galleries are in between the outer bricks, and the cells are in the cavities beyond the second course, so that it is impossible to measure the length of any one gallery, for the cells are mixed in the utmost disorder. The liking of these bees for the mortar of the chimney may be explained by the fact that the Richmond River Valley

¹) This remarkable name is said to be onomatopoeic, being the aboriginal term to describe the wind sighing in the trees, *Acacia adalaidae*.

is remarkably deficient in lime. The colony is within three feet of the steps to the back of the house, and the path to them is used regularly by the residents as they come and go".

ARCHITECTURE

The structure of the cradles varies greatly with the species. Cells taken from the colony at Bronte had been excavated from the solid sandstone, and are wide oval in shape, measuring 8 mm at the short axis, and 10 mm at the long (RAYMENT 1935). The actual lining is composed of five extremely thin layers of different materials, none of which is soluble in water, alcohol or turpentine. The greatest thickness of any is at the base of the cell, where it measures one mm. All the linings are laid down in thin "skins" that become brittle with age, but flake off each other very distinctly when broken (text fig. V, fig. 5).

The cells in the wasp's nest were lined with somewhat similar materials, the white substance being slightly waxy, but the chambers were solidly constructed, as though an abundance of material were available.

But the cells in the chimney colonies are irregular in shape, and frail (text fig. V, fig. 4); moreover, they are small, and consist of only the thinnest of white linings and the reworked dry mud of the bricks. The bees may require lime to elaborate the proper building material, which appears to contain traces of a biological substance, a kind of wax, but where the mineral is scarce, the architecture suffers in a result.

Where a gallery could be traced, it appeared to serve about ten cells. In all cases the cells were sealed with a plug of the building material. The white wax is secreted by the covered portions of the tergites (see pl. 5).

The cells are lined finally with a thin film of snow-white soft wax, which has the appearance of fine lard, and is certainly a secretion which covers the basal portion of tergites 3 to 6. That it is originally a liquid is proved by microscopical examination of the inner surface, which is a perfect cast of the peculiar scale-like sculpture of the tergite. The secreting area is overlapped by the apodeme of the preceding tergite, and the white "sheet" cannot be seen unless the two tergites are pulled out to the limit of the apodeme. The "sheet" of wax is broader at the ends, owing to the shape of the secreting surface. (The wax forms in crescentic scales on the sternites of the honey-bee) (text fig. V, fig. 2-3).

LARVAL DEVELOPMENT

The store, when first gathered, is a batter of honey and pollen, plus a small amount of some biological substance that has a determining influence on the growth of the larval bee. If from any cause the pudding is

not consumed soon after the sealing of the cell, it dries quickly into a ball about eight mm in diameter; the biological substance must be responsible for this change, since honey and pollen alone remains moist and soft.

The egg is deposited on the surface of the batter, to which it is attached, at the caudal pole, by an agglutinative secretion of the mother. The incubating period, and the time taken to consume the store, are not known, but the larvae, when fully fed, are large, and fat, and fill the cell, but are so exceedingly soft that it is impossible to lift one up without gravely altering its original form. The creatures are extremely delicate, and the author has not yet succeeded in rearing any to maturity.

As is usual among bees, the colours of those about to emerge from their natal cells are brighter than those of the field bees, and young females taken from the Lismore colony looked as if belonging to a different species; the thoracic hair being bright-red, with the abdominal fasciae yellowish, as in *salteri* and *vigilans*. It is a common thing to find the completely developed imago still wrapped closely in a delicate transparent skin. It is recorded in Europe that certain species take two years to reach their full development, and it seems that long periods are spent in the skin covering as described.

BEHAVIOUR OF THE INDIVIDUAL

The correspondents agree that the bees are abroad soon after seven o'clock, on bright sunny mornings, and they revel in the heat, though one observer reported that, on excessively hot days, they disappeared about eleven a.m., and were not seen again until four p.m., after which hour the bees worked on until seven p.m. The author suggests that in this case the nectaries of the plants ceased secreting nectar, as they often do during the hottest hours. At Orroroo, S. A., GRAY says the Anthophorids are harvesting fully as long as the honey-bee, and on some days are as numerous. At Port Phillip, V., the Anthophorids are exceedingly rare.

The bees are swift fliers, especially the males, which dart to and fro over the flowers, without alighting, for long periods. Both sexes have a high shrill note and, while the female is in a flower collecting pollen, she makes the continuous sound that has been compared with that of a honey-bee caught in a spider's web. The observer at Edungalba says he can hear her at a distance of fifteen feet. The wings do not appear to move while she is in the flower, and the sound could not be determined.

At Gunbower, the author noted that females excavating in the mud bricks made a continuous buzzing note, and the Lismore and Orroroo correspondents make a similar report on other species.

At Lismore, the bees were observed darting from flower to flower with the long mouth-parts fully extended, and that the bees seemed to

prefer flowers with a long corolla, into which they thrust the glossa for a hasty sip of nectar, and then darted away again as though afraid to tarry. In every case, the bees are extremely restless when a-wing, and difficult to capture. GRAY, too, remarks on the bees' preference for a long corolla.

The females carry large loads of pollen on the stout hind legs, which are exceedingly hairy, but the author has never observed them to hover, like the honey-bee, while the granules are being packed on the floccus; just how she manages to do this work is not easy to determine owing to her rapid flight. On returning to the colony, each female passes without hesitation into her own gallery, for the bees have no difficulty in orientating themselves. WHITELEY timed on female provisioning a cell, and found she was absent for only three or four minutes; this is corroborated by MURRAY WALLACE, at Hunters Hill.

The females often sit in the hot sun to ripen the nectar. The glossa is extruded, a globule of nectar runs down, and is then hastily withdrawn, so that a kind of "beating" motion is maintained by the glossa; an action common in *Halictus* (RAYMENT 1935).

BOUVIER, FRIESE and BUTTEL-REEPEN agree that colonies of European *Anthophorae* will make a concerted attack on the too zealous naturalist, but TOWNLEY, at Lismore, wrote that as many as forty or fifty bees flew about him as he removed the bricks from the chimney, but none offered any attack, and that was the experience of the author at Gunbower. Several other correspondents reported that the field-bees stung them when handled in the fingers; the pain, however, is slight, and does not persist for long.

At evening, the males congregate about a tall dry grass-stem, and taking hold with their mandibles, prop themselves out at right-angles, and rest throughout the night in that remarkable position. At Marrickville, the correspondent wrote that a severe hailstorm severed the bodies of the bees from the heads, which were left attached to the stalks by the clenched mandibles. The weight of the body appears to tighten the grip automatically, and apparently there is no strain in maintaining the horizontal position. Males of *Asaropoda* often rest in similar fashion among the *Anthophorae*.

The author, though having spent a life-time among the insects, has never witnessed the copulation of the *Anthophorae*, nor can he find a record by any other observer of the sexual act. One need not seek far for the explanation of this hiatus in our knowledge of the bees' life-history — the sexual congress has not been observed because it takes place in the secrecy and darkness of the large white cells.

This secretive habit of the *Anthophorae* complicates the task of the systematist, because the bees are never captured while coupled,

consequently there is the additional difficulty — except in the three cases where both sexes were collected at the nests — of associating them correctly, especially in the case of such critical species as *perpulchra*, *adamsella*, and *pulchra*. The author, therefore, is not absolutely certain he has paired them correctly in every case, since he has had to rely to some extent on the fact that the two have been taken together in numbers, at the same time, and on the same plants, by various collectors. Where the structural details agree the association has been accepted.

In 1937, the author visited the Island of Gunbower, in the river Murray, and between the mud-bricks of a farmer's house closely observed the busy traffic of pollen-laden females of *murrayensis* as they passed into celles which they had excavated in the bricks. The males hovered before the apertures of the galleries, and ever and anon one would follow a female in, and the pair would remain inside for several minutes.

The author has no doubt that copulation takes place in the cells, and PHILLIP WHITELEY, at Bronte, N. S. W., observed the nests of another species in the seacliffs, but he, too, failed to see the congress of the sexes. At Proserpine, Queensland, HARRY THOROGOOD observed the nest of yet another species, in the mud cells of a wasp, and he also failed to observe the sexes copulating.

DUDLEY TOWNLEY, describing the behaviour of *townleyella* in a large colony at Lismore, N. S. W., during February 1940, reported as follows:—

"There is a large number of females always present at the "nest", but though they are gregarious, each bee attends strictly to its own business, that is, its own series of cells. But a number of slightly smaller bees, which I take to be males, hover constantly in front of the galleries, and every now and then one will go inside".

PHIL RAU (1929) studied the biology of an American species, *A. abrupta*:—

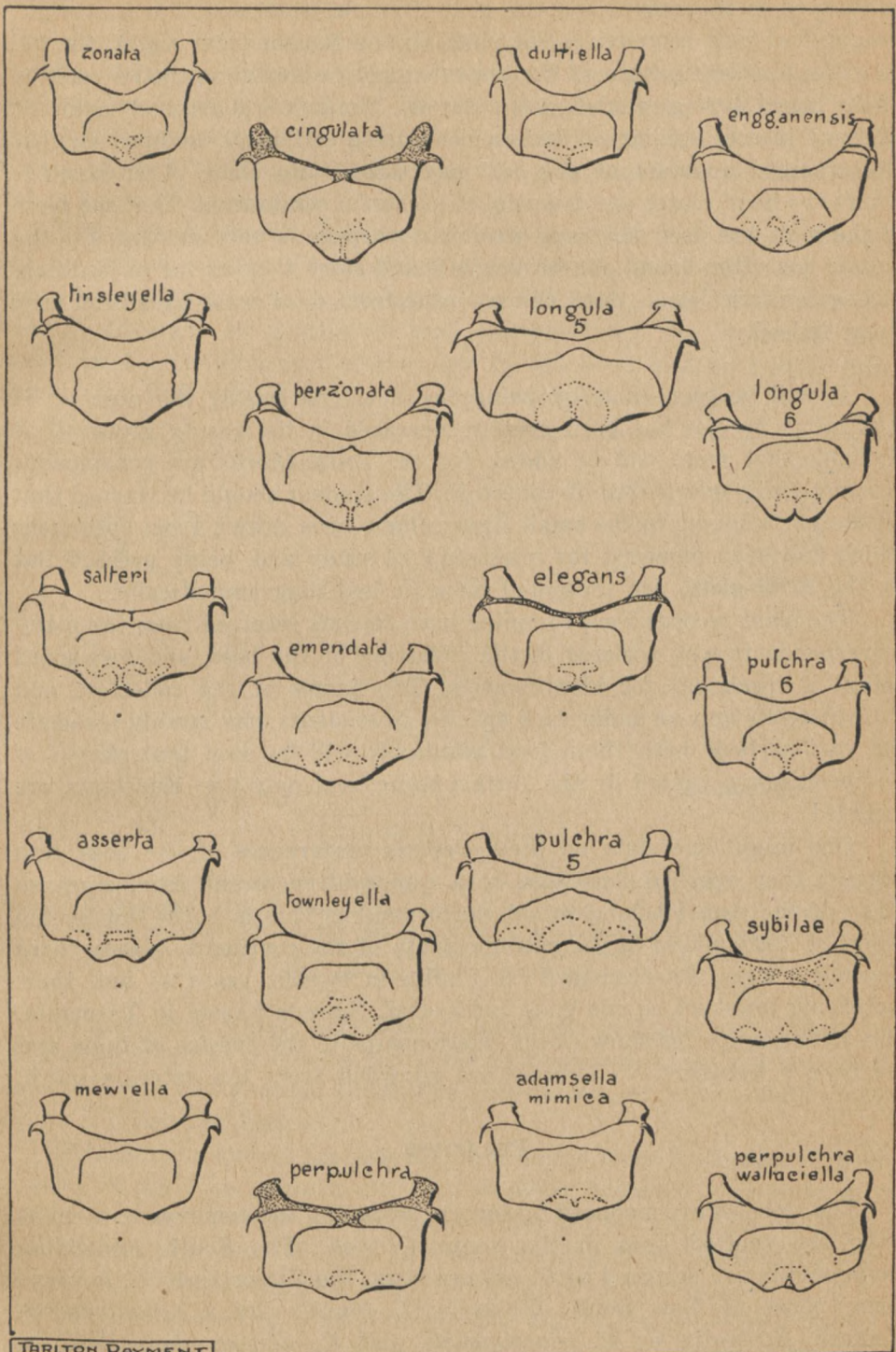
"I have never seen mating occur at the bank' (of earth) and I have often wondered if they do not go elsewhere for the purpose of meeting the females".

Describing a related species, *Entechnia taurea*, he says:

"There was one hole in particular about which they crowded thus in clamorous competition — it seemed they could scent the female within, and could not be driven from the spot".

These four records of the behaviour of Australasian *Anthophorae* at their nests are the only ones known, and the observers agree that the males followed the females into the galleries.

The plate of the female, and the dentate structure of the male, probably function during coition in the darkness and confinement of the cells, and could act as a gauge to maintain the insects in an effective position. It will be noted that a concave formation between the teeth of the male



Text fig. IV. Sixth ventral segments of *Anthophora* males, No. 5 is the fifth sternite.

is adapted to the convex contour of the female plate, and that a straight line on the male connotes a flat plate on the female (text fig. 1, fig. 7).

The precise function of the plates cannot be known until the position of the insect during copulation is observed. The apical abdominal segments of many insects are curved underneath during coition in the open air, but the cramped quarters of the cell may necessitate some other posture, where the bees' plates are essential to successful semination. That the teeth of the male are used for some strenuous purpose is very evident, for the author has often found one broken off, and since they are of exceedingly strong construction — thick chitin — the force used must have been very great indeed.

It will be seen that, by using the new characters, the number of Australian species has been greatly increased in the *zonata* group. It is probable that more will be added, for the *Anthophorae* are conspicuous bees not easily overlooked by collectors. The student should be warned that all the parts shown in the small figures have been drawn from specimens which had been mounted for microscopical study and, being pressed flat by the cover-glass, are presented more or less diagrammatically.

The plant records were compiled from reports received from the many correspondents who assisted in the collecting of the bees, and forwarded botanical specimens for identification. The names of the collectors and their districts appear under each species, so students may readily associate the various bees with their food plants. It will be seen that very few Composites are visited by the *Anthophorae*, and only two Eucalypts are included.

One might speculate on these curious preferences of the bees, and suggest they reached Australia at a comparative recent date, since so many of the plants belong to old-world genera. This is borne out by the rarity of *Anthophora* in the extreme south of the continent — only three specimens were observed at Port Phillip in twenty years — and their increasing numbers as one goes northward. None is known in Tasmania. The northern species show closer relationships to the species of India and the islands between. No *Crocisa* are recorded from the extreme south.

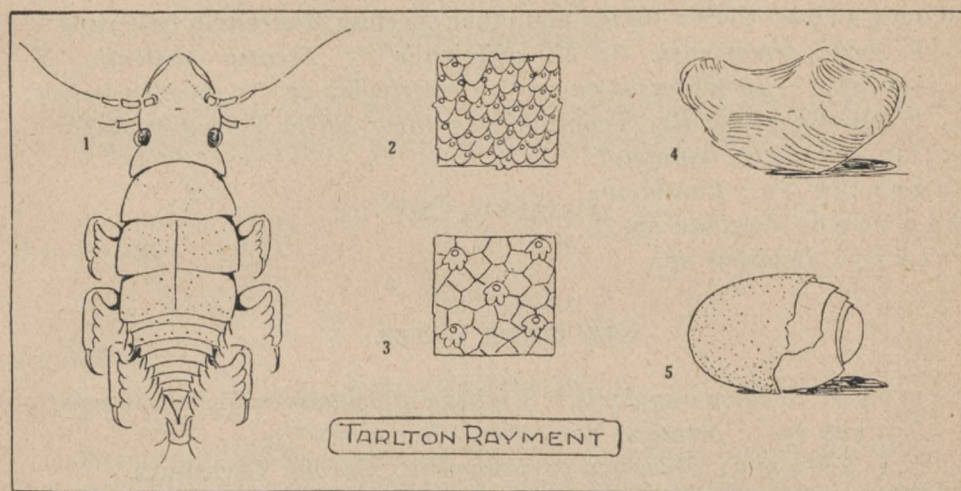
PARASITES

The colonies are menaced by several parasites, the commonest enemies being the spotted bees in the genus *Crocisa*. The South Australian *Anthophorae* are pestered by *C. waroonensis*; the Victorian by *C. lamprosoma*; those of New South Wales by *C. omissa* and *C. lugubris*; in Western Australia by *C. waroonensis* and *C. albomaculata*; and in Queensland by *C. darwini*, *C. beatissima* and *C. lamprosoma*. In Java,

according to M. A. LIEFTINCK, by *C. pulchella* GUÉR., *C. pernitida* (CKLL.), *C. abdominalis* FR., and probably a few more.

The larvae of these bees do not consume the larvae of the host, but confine themselves to the store, but since they do not eat the whole of it, the rightful progeny often emerge as dwarfs only one quarter of the normal stature. These abnormal forms will surely mislead the taxonomist unless he be on his guard.

A fly (*Miltogramma*), however, is more destructive, since it consumes, not the stores, but the whole of the larval bee. Up to twenty-four pupal cases of the fly were taken from one bee-cell, and many others were as heavily infested. At Bronte, it was observed that the parasitic flies maintained a position just at the rear of the bees, and no matter how quickly the bees darted about, the flies could not be evaded.



Text fig. V. *Anthophora*. Fig. 1, Parasitic insect on *A. engganensis* (see diagnosis); 2, Sculpture on hidden portion of tergite where the wax is exuded; 3, Sculpture on exposed portion: note the piliferous punctures on both; 4, Iris-shaped mud-cells of *A. townleyella*; 5, Regular cell, from sea-cliffs, showing the five thin linings.

Slender black wasps were seen at Mossman, and also at Lismore, to enter a shaft in the ground after some *Anthophorid* males had emerged. However, cyclonic weather conditions supervened, and the colony could not be investigated further.

Although the author has taken Acarid mites from the bodies of bees in most of the other genera, yet he has never observed a mite on any of the several hundred *Anthophorae* examined during this research. The blue-banded bees have a unique freedom from these universal parasites, but the reason for their immunity is not known.

Several minute elongated insects (text fig. V, fig. 1) were removed from the exterior of the tergites of *A. engganensis*, and on dissecting the abdomen of another male from Padang, West Sumatra, the larval

pellicle of insect was observed in the interior, but owing to the age of specimen — it is many years old — and the bad condition of the internal organs it is impossible to determine which part contained the parasite; the author suggests that these creatures pass their larval stages inside the body of the male bees, certainly not in the tracheal tubes, but probably in spaces between the internal organs.

List of Plants
known to be visited by *Anthophora*
(Those marked with a * are introductions to Australia).

QUEENSLAND.

Mossman: Mango Trees; *Antigonon leptopus* *.
Edungalba: *Cassia fistula* and other species: *Maurandia baileyana* *;
Verbena bonariensis *; *V. officinalis* *; *Tecoma australis*; *T. capensis* *; *Ipomoea purpurea* *; *Convolvulus* sp. *; *Pavetta indica*;
Plectronia attenuata; *Teucrium argutum*; „Wild Pomegranate?”
Tully *Antigonon leptopus* *.
Magnetic Is.: *Cassia* sp.
Stanhope: *Lantana* sp. *.
Mackay: *Hibiscus* sp.

NEW SOUTH WALES.

Lismore: *Begonia angularis* *; *Verbena officinalis* *; *V. bonariensis* *;
Lantana sp. *; *Nandina domestica* (Japanese) *.
White Swamp: *Solanum purpuraceum*; Garden Larkspurs.
Id., Macpherson Range: *Statice* *; *Verbena* sp. *; *Lantana* *;
Franciscea = *Brunfelsia calycina* *; *Thysanotus fimbriatus*; *Carduus*
sp. *; *Solanum sturtianum*; *Hardenbergia*; *Lomatia*; *Kennedya*
rubicunda; *Ipomoea* sp. *; *Convolvulus* sp. *; *Clarkia* *; *Stachys* sp. *;
Stocks *; Radish *; Watermelon *; Potato *; *Phlox* *; *Digitalis* *.
Hunters Hill: *Ipomoea* sp. *; *Convolvulus* sp. *; *Lantana* sp. *.
Woollahra: *Ipomoea* sp. *; *Convolvulus* sp. *; *Lantana* sp. *.
Sydney: *Persoonia* sp. *; *Convolvulus* sp. *; *Lantana* sp. *.
Gosford: *Begonia* sp. *; Tomato *; Potato *; *Lantana* sp. *.
Barham: *Tecoma* sp. *; Apple Bush (*Sideroxylon australis*).
Brokenhill: *Eucalyptus leucoxylon* var. *macrocarpa*; *Eremophila*
alternifolia, *E. scoparia*, *E. bignoniiflora*, *E. maculata*, *E. glabra*, and
E. macrocarpa; *Cassia sturtii*; *Solanum sturtianum*; *Hibiscus rayii*;
Genista sp.; *Mesembryanthemum* sp.; *Gossypium sturtii*; *Melaleuca*
acuminata; *Petalostylis labicheoides*; *Frankenia pauciflora*; *Eucalyp-*
tus gillii and *E. oleosa*; *Cercidium torreyanum*; *Aloe*.

Silverton: *Loranthus preissii* (Mistletoe).
 Mittagong: *Buddleia* sp. *; *Statice* *.
 Robertson: *Tecoma* sp. *; *Ipomoea purpurea* *; *Buddleia* *.
 Como: *Eucalyptus grandis*.

VICTORIA.

Diamond Creek: *Gladiolus* sp.; English Lavender.
 Sandringham: *Begonia* sp. *; *Heuchera* sp. *; *Dianella revoluta*;
Hypochaeris radicata * (rarely).
 Briagolong: Tomato *; *Ipomoea purpurea* *.
 Gunbower: *Teucrium racemosum* *; *Callistemon*, doubtful.
 Croydon: *Leptospermum* sp.

SOUTH AUSTRALIA.

Orroroo: *Atriplex* sp.; *Teucrium racemosum* *; *Echium plantagineum*;
Eremophila sp.; *Aster* sp. *; *Leptospermum* sp.; Myrtles ?; Stocks *.

WEST AUSTRALIA.

No record.

TASMANIA.

No record.

JAVA AND SUMATRA ¹⁾.

Zingiberaceae: *Globba marantina* BL. (!); *Amomum megalocheilos* BAK.;
Achasma puniceum ROXB. (= *Amomum coccineum*); *Zingiber*
odoriferum BL.; *Hornstaedtia* spec.; *Curcuma zeodaria* BERG. (!);
Phaeomeria solaris K. SCH.; *Costus speciosus* SM. (!); *Hedychium*
roxburghii BL.
 Marantaceae: *Donax canniformis* K. SCH. (!).
 Amaryllidaceae: *Curculigo capitulata* O.K. (!).
 Pontederiaceae: *Eichornia crassipes* MART. *.
 Verbenaceae: *Stachytarpheta*, all species * (!); *Lantana camara* L. * (!);
Vitex negundo L.
 Labiatae: *Hyptis suaveolens* POIT. * and *capitata* JACQ. *; *Ocimum*
basilicum L.; *Leonotis nepetifolia* R. BR. *; *Coleus galeatus* BTH. (!);
Achyrosermum densiflorum BL. (!); *Leucas lavandulifolia* SM. (!);
Paraphlomis oblongifolia BACK. (!); *Scutellaria javanica* JUNGH.

1) The following list of plants was added to this paper by Mr. M. A. Lieftinck (Buitenzorg Museum, Java). Plants frequented by *Anthophora* are marked with a (!); those marked * are introduced in Malaysia.

- Acanthaceae: *Peristrophe bivalvis* MERR. (!); *Thunbergia grandiflora* ROXB. *; *Strobilanthes cernuus* BL., *S. diclipteroides* MIQ., and other species; *Acanthus ilicifolius* L. (!); *Hemigraphis colorata* BL.
- Gesneraceae: *Cyrtandra* cf. *cuneata* BL., *Pendula* BL., *Repens* DE VR. and several other species (!); *Saintpaulia kewensis* CLARKE * (!); *Trichosporum longiflorum* DC.; *Cyrtandromoea decurrens* Z. & M. (!); *Didymocarpus barbata* JACK.
- Balsaminaceae: *Impatiens platypetala* LINDL., *chonoceras* HASSK. (!); and *oncidoides* RIDL. & HOOK. f. (!).
- Polygalaceae: *Polygala venenosa* JUSS.
- Malvaceae: *Hibiscus tiliaceus* L.
- Convolvulaceae: *Ipomoea pes-caprae* SWEET. and *I. learii* PAXT. *.
- Sterculiaceae: *Helicteres viscida* BL.
- Dilleniaceae: *Saurauia pendula* BL. and *S. nudiflora* DC.
- Vitaceae: *Leea* spp. (rarely).
- Begoniaceae: *Begonia* spp. (rarely).
- Leguminosae: *Mimosa asperata* L. * and *invisa* MART. * (Mimos.); *Vigna lutea* GRAY (Papilion.); *Cassia obovata* COLLAD. * (Caesalpinia).
- Myrtaceae: *Leptospermum javanicum* BL.; *Eugenia densiflora* DUTHIE.
- Passifloraceae: *Passiflora edulis* SIMS. * and *P. quadrangularis* L. *.
- Asclepiadaceae: *Calotropis gigantea* WILLD.
- Melastomataceae: *Osbeckia chinensis* L.; *Medinilla javanensis* BL.
- Turneraceae: *Turnera ulmifolia* L. or *subulata* SM. *.

Coppery and Green Species.

Aeruginosa, and the very beautiful new species, *sybilae*, are included in this research because a critical study of the morphology reveals that both are derived from the *chlorocyanea* tribe. The coppery colour of SMITH's bee, and the remarkable green of *sybilae*, are due to the extension of the fasciae over the whole of the tergites. The face-markings of males of *sybilae* approach those of *pulchra*, and those of *aeruginosa* are farthest away.

The eighth plate shows the close relationship to the *chlorocyanea* tribe, though the sixth sternite approaches *cingulata* which, of all Australian bees, is nearest to *zonata*. Both have the serrated process on the seventh abdominal plate; more prominent on extreme specimens of *aeruginosa*, and obsolete on extreme specimens of *sybilae*. The sixth sternite of *sybilae* has a small elevated area, but that of *aeruginosa* is simple.

The stipes has a small tooth in *aeruginosa*, but a large triangular one in *sybilae*, and the row of spines on the first is only half way across, while in the second it is complete in extreme specimens (text fig. VI, fig. 4 A and S). Comparison of the apical plates of the males shows that the line between the teeth conforms to the general curve of the abdomen

in *aeruginosa*, but is beyond it in *sybilae*. The typical abdomen of the first is short, with a high ovoid section, but that of the second is longer, with a much flatter section.

Between these two extremes there is a form from Mossman, Q. which perhaps should be regarded as a subspecies of *sybilae*, in which case it might take the name *glauca*. A unique male from Claudie river, Northern Queensland, has the apical plate deeply concave between the teeth; the hair of the mesothorax is foxy-red, that of the legs yellowish. This, too, should be separated, and might take the name *kershawi*, after the collector, JAMES KERSHAW, sometime Director of the National Museum, Melbourne, V.

***Anthophora aeruginosa* SMITH.**

Cat. Hym. B.M., ii, p. 336, 1854.

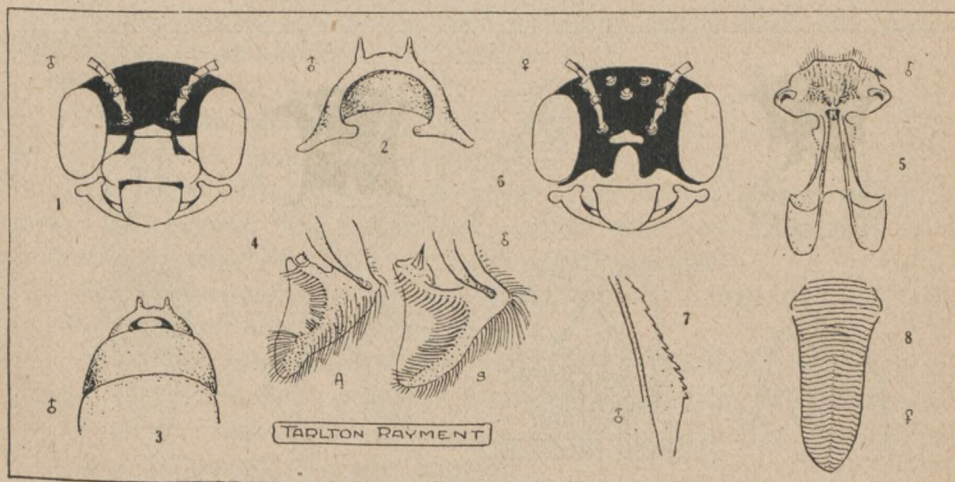
Female: Length, 11 mm approx.

Face-marks yellow, like a dome on clypeus, which has white hair laterally; hair of frons yellowish, of vertex deeper, with much black; hair of genae yellowish fading to white; scape black, flagellum light-red beneath.

Disc of mesothorax with dense russet and black hair; pleura with yellowish hair fading to white.

Abdomen covered with dense coppery-coloured hair having slight greenish reflections. Plate with striae persisting throughout over a sharp median carina.

Legs with opalescent hair on anterior and median pair, almost white on hind.



Text fig. VI. *Anthophora aeruginosa* Smith. Fig. 1, Head-capsule; 2, Apical plate; 3, Apex of venter; 4, Apex of stipites (4A of *A. aeruginosa*, 4S of *A. sybilae*, sp. n.); 5, Seventh sternite; 6, Head capsule; 7, Serrated process, enlarged view; 8, Apical plate.

Male: Length, 10 mm approx.

Face-marks yellow, that of the clypeus broadly truncate above, the wide lateral ones as high as clypeus; hair of frons pale-ochreous, of vertex golden and black fading to pale-blue on genae; scape yellow in front, flagellum light-red beneath.

Disc of mesothorax with copper-coloured hair mixed with black; hair of pleura palest-blue.

Abdomen covered with dense copper-coloured hair with yellowish-green reflections. Plate convex between the long sharp teeth.

Legs with whitish opalescent hair. Sixth sternite simple.

Allies: *sybilae*, which has a green aspect, and less hair on frons and disc of mesothorax.

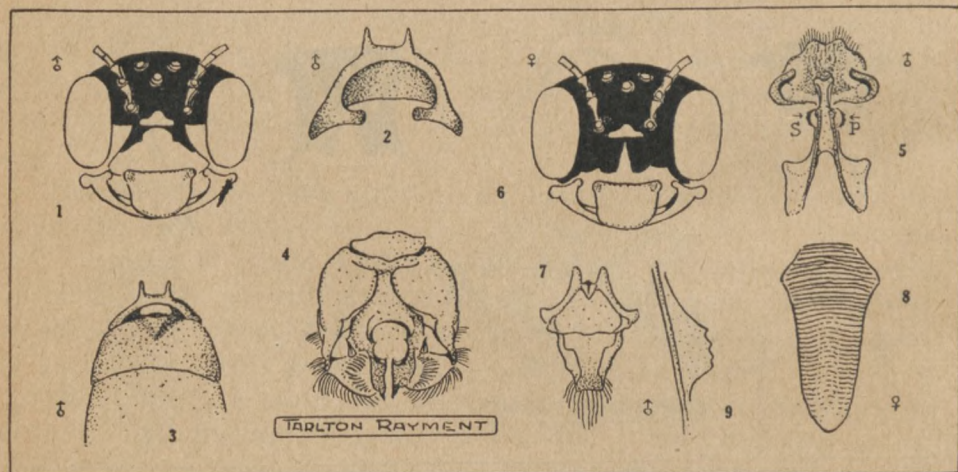
Locality: Extreme forms from Wyndham, W. A., and Magnetic Island, Q., Claudie River, N. T. Typical forms from Townsville; Tully; Proserpine; MacIntosh Holding; Edungalba; Cairns; Kuranda; Bribie Is.; Duaringa; Gordonvale; Mossman, Q.; Port Darwin, N. T.; Hunter River; Lismore, N.S.W.

***Anthophora sybilae*, sp. nov.**

Female: Length, 11 mm approx.

Face-marks yellow, sharply pointed on clypeus, apex sometimes fails to reach supraclypeal mark; hair of frons greenish-white, but blue at sides of clypeus; hairs of vertex light-amber, palest-green and black; genae with palest-blue hair with emerald-green reflections; scape and basal segment of flagellum black, other segments light-ferruginous beneath.

Disc of mesothorax with sparse emerald-green hair mixed with black; hair of pleura palest-blue with opalescent reflections.



Text fig. VII. *Anthophora sybilae*, sp. n. Fig. 1, Head-capsule; 2, Apical plate; 3, Apex of venter; 4, Genitalia; 5, Seventh sternite, SP serrated process; 6, Head-capsule; 7, Eighth sternite; 8, Apical plate; 9, Serrated process, enlarged view.

Abdomen covered with dense mossy-green hair showing iridescent emerald-green and brilliant golden reflections; in fresh specimens the colour scintillates with the beauty of the opal. Plate with striae failing along a wide median line and apically.

Legs with palest emerald-green hair with blue reflections.

Male: Length, 9-10 mm approx.

Face-marks yellow, contracted to a dome on clypeus; the wide lateral marks as high or higher than clypeus, which has bluish hair laterally; hair of frons pale-ochreous, of vertex yellow and black.

Disc of mesothorax with sparse greenish-russet hair; pleura with pale greenish-blue hair.

Abdomen covered with dense mossy-green hair like the female; hind margins of segments (on extreme forms) of golden colour which, with the green, is singularly striking on fresh specimens. Plate straight between the fine long teeth. The sixth sternite has a small peculiar elevated triangular area.

Legs with opalescent green hair.

Allies: *aeruginosa*, which has a coppery aspect, with more hair on frons.

Locality: Mossman, and McIntosh Holding, Q. and 20 miles S.E. to Edungalba inclusive; Magnetic Is.

Species dedicated to SYBIL TOWNLEY, in appreciation of her assistance.

A. — *A. chlorocyanea* series

It is deemed advisable to conclude Part I of this revision with the species in the *chlorocyanea* series, all the females of which lack the lateral face-marks, as in *aeruginosa*, and so stand apart from the *pulchra* (Part II) and *zonata* (Part III) series.

Anthophora adamsella, sp. nov.

Female: Length, 9 mm approx.

Face-mark ivory, like an inverted \perp on clypeus, no lateral marks; frons with sparse pale-bluish hair; vertex with dull white hair mixed with black; scape and flagellum ferruginous beneath.

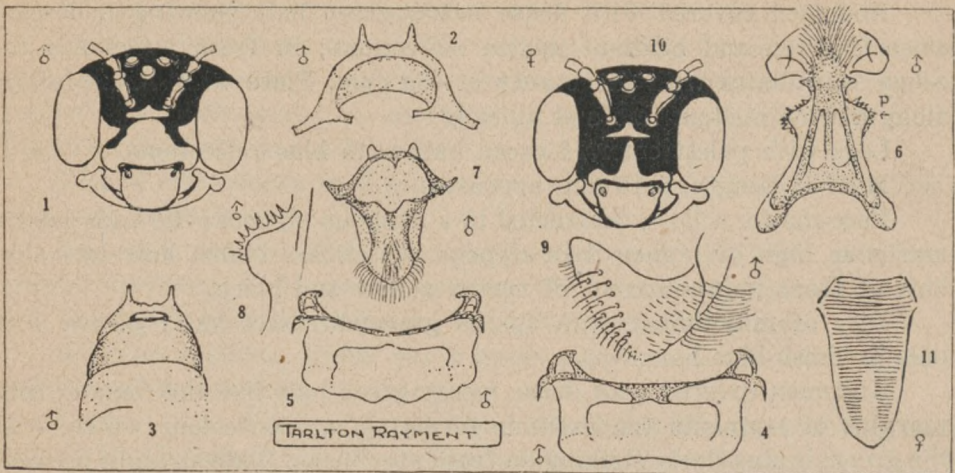
Disc of the mesothorax with silvery-green hair intermixed with black; scutella similar; hair of pleura bluish.

Abdominal fasciae white with dull-bluish reflections. Plate short and broad, with striae failing along a short narrow median line and distally.

Legs with dull white hair on hind; bluish on anterior and median pair.

Male: Length, 8.5 mm approx.

Face-marks ivory, the wide lateral ones not as high as clypeus, which has a few scattered white hairs; hair of frons bluish; of vertex mostly black; scape yellow in front, flagellum dull ferruginous beneath.



Text fig. VIII. *A. adamsella*, sp. n. Fig. 1, Front of head-capsule; 2, Apical segment; 3, Ventral segments (simple); 4, Fifth sternite; Sixth sternite; 6, Seventh sternite; 7, Eighth sternite; 8, Lateral process of eighth sternite (P) enlarged; 9, Apex of stipite.

Disc of mesothorax with greyish-green hair mixed with black; scutella similar, but disc sparsely clothed in many specimens.

Abdominal fasciae as in female; punctures more evident than in other species. (See *cinctofemorata*). Plate slightly undulate between sharp teeth. Apical segments of venter not emarginate. Seventh and eighth sternites blackish.

Legs similar to female.

Allies: *cinctofemorata* and *chlorocyanea*.

Locality: Edungalba, Q., Jan. 1940, ERNEST E. ADAMS. Proserpine, Q., H. THOROGOOD. Mossman, Q., May 1940, J. SHAFFERY.

Anthophora australis, sp. nov.

Female: Length, 12 mm approx.

Face-mark ivory, pointed at apex; frons and vertex with white hair; genae with pale-blue hair; scape black, flagellum ferruginous beneath.

Disc of mesothorax with white and black hair; pleura with palest-blue hair.

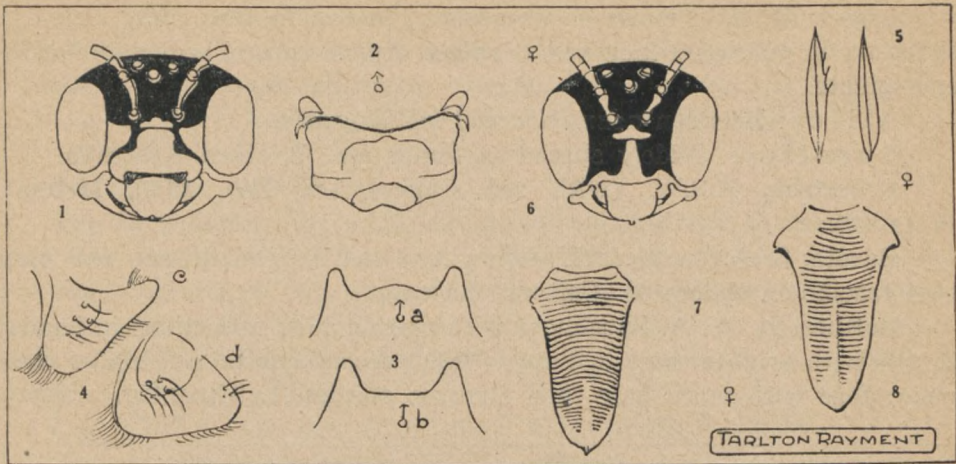
Abdominal fasciae bright-blue, with mother-o'-pearl tints, but no green. Plate with striae failing along a sharp median line and apically.

Legs with palest-blue hair.

Allies: Only females available, but definitely near *chlorocyanea*.

Locality: Sandringham, V., Dec. 1939, RAYMENT (*Begonia* sp.) and Nov. 1936, J. ZIEGLER (*Dianella revoluta*).

This delicate southern species is extremely rare, only three females being taken over 20 years.



Text fig. IX. Fig. 1. — ♂ *A. mimica*, sp. n., front of head-capsule; 2, *A. mimica*, sp. n., sixth sternite; 3, Apical plates of *A. mimica*, sp. n. (a) and *A. ernesti*, sp. n. (b); 4, Apices of stipes of *A. ernesti*, sp. n. (c), and *A. mimica*, sp. n. (d); 5, Only a rare scale of *A. australis*, sp. n. shows serrations. ¹⁾

Anthophora chlorocyanea COCKERELL.

Ann. Mag. Nat. Hist. (8), xiv., p. 469, 1914.

Female: Length, 13 mm approx.

Face-mark deep-ivory, high narrow pyramid on clypeus which is practically nude; hair of frons pale-straw with bluish reflections; vertex with dense ochreous hair mixed with black; hair of genae bluish; scape black, flagellum ferruginous beneath.

Disc of mesothorax with greyish-green hair, with blue reflections, mixed with black; scutella with light fulvous; hair of pleura blue with greenish reflections.

Abdominal fasciae palest-green with blue and golden reflections, the last more marked on basal one. Apically, the greenish hair goes clear across. Plate with striae failing distally and along a short median line.

Legs with dull-white hair showing green and blue reflections.

Male: Length, 11 mm approx.

Face-marks deep-ivory, lateral ones not nearly so high as clypeus; a few white hairs laterally on clypeus and frons; vertex with ochreous hair mixed with black; scape ivory in front, flagellum blackish with a ferruginous spot basally.

Disc of mesothorax as in female; hair of pleura bluer.

Abdominal fasciae as in female.

¹⁾ Note. — *A. mimica* = *A. adamsella mimica* on Text fig. 4, but the author suppressed its description. The figures are drawn after a single ♂ specimen, caught Nov. 4. 1939 at Edungalba. Q. *A. ernesti* will be described in the second part as *A. adeluidae ernesti* subsp. nov. The explanation of figs. 6, 7 and 8 of text fig. IX was lacking in the MS. (the Editor).

Legs with hair more bluish-green. Plate with low curve between sharp teeth, which are incurved at apices. Apical ventral segments hardly emarginate.

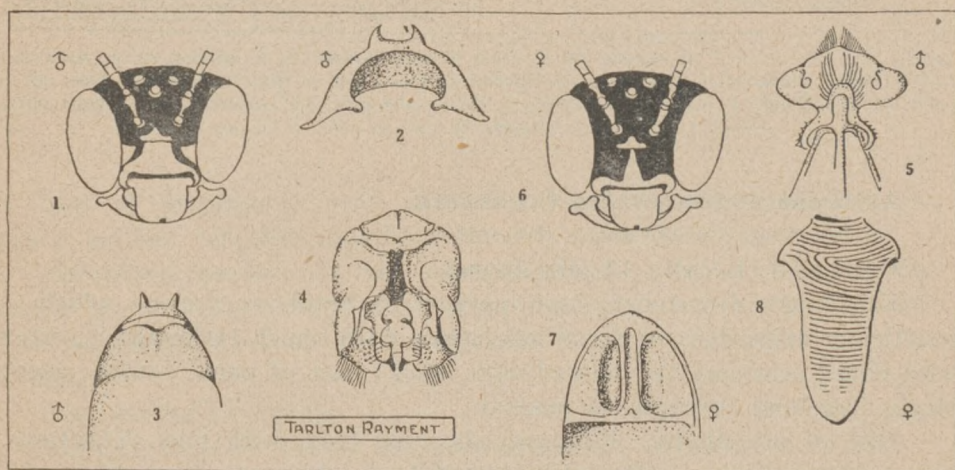
Allies: Between *adamsella* and *murrayensis*.

Locality: Widely spread in South and Western Australia.

Robertson, N.S.W. (with red scapes) 1st. Feb. 1940, MURRAY WALLACE.

Barota, S. A. (with dark scapes, foxy-red hair on thorax, and very blue fasciae on abdomen). Coll. not known.

Rottnest Is. W. A. Specimens with more golden reflections in bands; thorax with brighter hair tending to foxy; second cubital cell higher than wide; face with more hair than Orroroo species. L. GLAUERT.



Text fig. X. *A. chlorocyanea* CKLL. Fig. 1, Front of head-capsule; 2, Apical segment of abdomen; 3, Ventral segments are very slightly emarginate; 4, Genitalia; 5, Seventh sternite; 6, Front of head-capsule; 7, Under surface of apical plate; 8, Apical plate.

Anthophora cinctofemorata SICHEL.

DOURS, Mon. Icon. Anthophora, 1869.

Female: Length, 11-12 mm approx.

Face-mark deep-ivory, like an inverted \perp on clypeus: „face” almost naked except for a patch of white hair behind scapes; vertex with palest-straw hair intermixed with black; scape with a minute yellow spot on some, flagellum ferruginous.

Disc of mesothorax with ochreous hair mixed with black, but a naked area about the centre; scutella similar; hair of pleura white, with palest-green reflections.

Abdominal fasciae pale-green with mother-o'-pearl reflections. Plate short and broad, with striae failing on apical third. Green prismatic hair on sixth tergite going clear across.

Legs with dull-white hair showing mother-o'-pearl reflections.

Allies: Between *chlorocyanea* and *adamsella*, which is smaller, with no greenish reflections in bands. Peculiar for having no serrated processes on titillatum which are common to the group.

Locality: Barham, N.S.W., Jan. 1940, E. THOMAS.

***Anthophora grayella*, sp. nov.**

The face-marks are exactly as in *luteola*, but the thoracic hair is grey, and the abdominal fasciae are distinctly palest-green with golden and rose reflections. The largest females have the striae failing over a large portion of the plate. There are not any black hairs on the clypeus. None of the sternites of the males is emarginate, and the apical plate is straight between the teeth.

Locality: Orroroo, S. A., Mar. 1940, JAMES T. GRAY.

The species is dedicated to the collector, who has given much assistance in the collection of the material.

***Anthophora luteola*, sp. nov.**

Female: Length, 12-13 mm approx.

Face-mark pale-yellow, like a long narrow pyramid on clypeus; no black hair on clypeus; dense hair of frons straw-colour with bluish reflections at sides; vertex with ferruginous hair; scape and flagellum reddish beneath.

Disc of mesothorax with dense ferruginous hair intermixed with a few black ones; scutella similar; hair of pleura pale-blue with greenish reflections.

Abdominal fasciae pale-green with strong golden reflections which, in some lights, obscure the green. Plate with striae persisting throughout.

Legs with dull-white hair, but this has mother-o'-pearl reflections.

Male: Length, 10 mm approx.

Face-marks yellowish, lateral ones lower than apex of clypeus, which has palest straw-coloured hair — no black on clypeus — yellower at sides; scape yellow in front, flagellum ferruginous beneath. (Orroroo females with flagellum all dark¹).

Disc of mesothorax and scutella as in female.

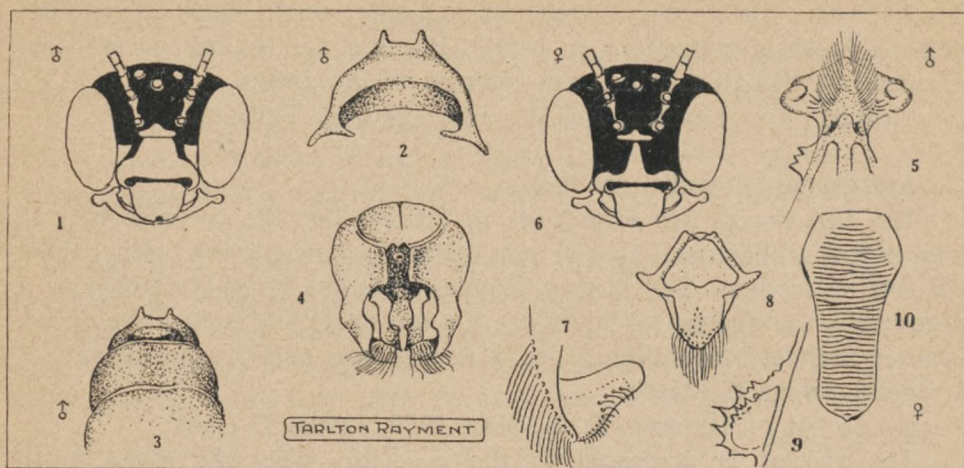
Abdominal fasciae showing stronger golden reflections. Plate straight between teeth; apical ventral segments not at all emarginate. Abdomen nearly parallel-sided.

Legs with dull-white hair showing greenish-yellow reflections.

Allies: Between *murrayensis* and *chlorocyanea*.

Locality: Black Rock Hills, S. A., 10th Feb. 1940, JAMES T. GRAY. Gunningbland, N.S.W.; specimens larger, with shovel-shaped abdomen.

¹) Note: Orroroo is not mentioned in the locality list of this species, and the MS. does not give any information as to which other species these females should belong. (the Editor).



Text fig. XI. Fig. 1, *A. luteola*, sp. n. Front of ♂ head-capsule; 2, Apical segment of abdomen; 3, Ventral segments (simple); 4, Genitalia; 5, Titillatum has three serrations; 6, Front of ♀ head-capsule; 7, Portion of stipe of *A. l. murrayi*, subsp. n.; 8, Eighth sternite of abdomen; 9 Serrated process of seventh sternite of subspecies; 10, Apical plate of ♀ typical form.

***Anthophora luteola murrayi*, subsp. nov.**

A form from N.S.W. looks superficially like the species, except that the lateral face-marks of the male are a trifle lower on the „face”, which has more white hair.

Examination of the genitalia and the seventh and eighth abdomen plates of the males show very decided differences, the apex of the seventh plate being truncate (rising to a point in the species), and the serrated process having many points (three in the species). The tips of the stipes bear many spines in the subspecies, but these are lacking in the species. The disposition of the hair is quite different.

Murrayi should perhaps have specific rank, for it is to *luteola* what *kershawi* is to *aeruginosa*, except that the apical plate of the males is almost identical. But for this likeness *murrayi* would have been given specific rank.

These two bees can be separated only after dissection.

Locality: Robertson, N. S. W., March 1940, MURRAY A. M. WALLACE.

The subspecies is dedicated to the collector, to whom the author is indebted for very large and beautiful series of several species, together with biological notes.

***Anthophora mewiella*, sp. nov.**

Female: Length 12 mm approx.

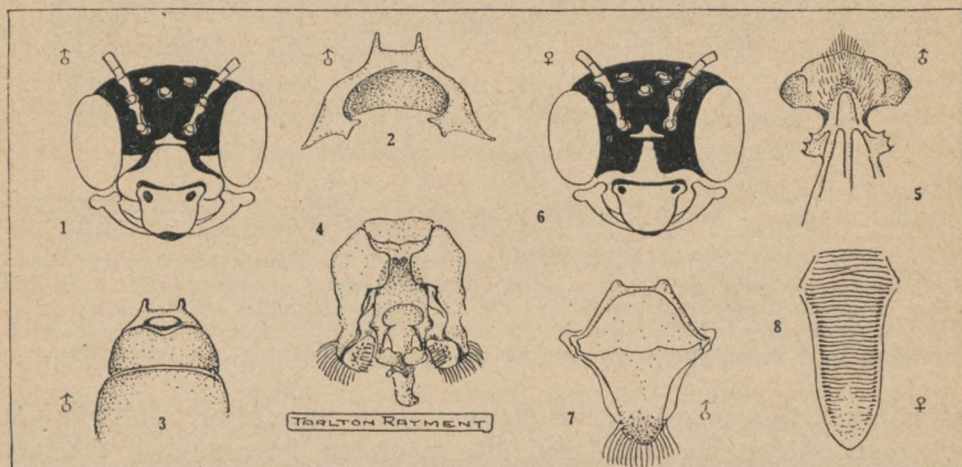
Face-mark deep-ivory, like a narrow pyramid on clypeus; no black hair on clypeus; hair of frons creamy, with pale-blue reflections; hair of

vertex ochreous with black; hair of genae fading to white with blue reflections; scape black, flagellum ferruginous beneath.

Disc of mesothorax with hair of a clear buff-colour mixed with black; scutella more fulvous; hair of pleura palest-green with blue reflections.

Abdominal fasciae greenish-white, with golden reflections. Plate with sharp margins, the striae failing apically.

Legs with white hair reflecting mother-o'-pearl tints.



Text fig. XII. Fig. 1, *A. mewiella*, sp. n., Front of ♂ head-capsule; 2, Apical segment of abdomen; 3, Ventral segments (simple); 4, Genitalia; 5, Seventh sternite: note three spines of process; 6, Front of ♀ head-capsule; 7, Eighth sternite; 8, Apical plate.

Male: Length, 10 mm approx.

Face-marks deep-ivory, lateral ones lower than apex of clypeus, which has two or three black hairs on the black portions; hair of head as in female; scape ivory in front, flagellum ferruginous beneath.

Disc of mesothorax with hair brighter than female, and scutella light-fulvous.

Abdominal fasciae greenish-white, the golden reflections on basal two almost orange-red. Plate straight between sharp, widely-spaced teeth, which do not incurve; apical ventral segment slightly emarginate.

Legs with bluish-white hair with golden reflections.

Allies: *chlorocyanea* and *luteola*; these are to *chlorocyanea* what *dutiella* is to *zonata*.

Locality: Silverton, N. S. W. (on *Loranthus preissei*) and Broken Hill, N. S. W. (Yellow Broom), Feb. 1940, R. H. MEW. Orroroo, S. A., and Black Rock Hills, S. A., Feb. 1940, JAMES T. GRAY.

Anthophora tinsleyella, sp. nov.

Both sexes look just like small *grayella*, but the apical plate of the female has the striae persisting throughout. The differences in the



Text fig. XIII. Fig. 1., *A. tinsleyella*, sp. n., eighth sternite; 2, The same, seventh sternite; 3, Apices of stipites of *A. tinsleyella*, sp. n. (a), *A. t. jamesi*, subsp. n. (b), and *A. grayella*, sp. n. (c); 4, Serrated process of seventh sternite of *A. grayella*, sp. n. (d), *A. tinsleyella*, sp. n. (e), and *A. t. jamesi*, subsp. n. (f); 5, Apical segment (alike for all); 6, Sixth sternite (alike for all); 7, Apical plate of *A. grayella*, sp. n.; 8, Apical plate of *A. tinsleyella*, sp. n. (similar to that of *A. t. jamesi*, subsp. n.).

structure of the winged process of the seventh sternite are shown in the diagrams. The author would not have separated these only for the fact that large numbers show the constancy of the species.

A very large series from MacIntosh Holding, via Edungalba, Q., many hundreds of miles distant, exhibited no differences whatever; these belong to the fauna of Central Australia, and were collected by ERNEST E. ADAMS.

***Anthophora tinsleyella jamesi*, subsp. nov.**

This subspecies is also related to *luteola* and *grayella*. The hair of the mesothorax is a lively buff shade. The apical plate of the female has the striae persisting throughout, as in the species. The lateral yellow marks of the males of these three are very short, falling conspicuously below the level of the supra clypeal mark. Lateral processes different, as shown in the diagram (text fig. XIII, fig. 4 f).

Locality: Orroroo, S. A., Mar. 1940, JAMES T. GRAY.

SUMMARY BY EDITOR

This revision consists of three parts:

- 1°. an introductory chapter, and a description of the *chlorocyanea* series and its near allies;
- 2°. the *pulchra* series, all of which are Australian;
- 3°. the *zonata* series, being Eastern, with the exception of 4 or 5 Australian ones, which have been included in the 2nd part.

Part I. The *zonata* group of *Anthophora* derives its name from an Indian species named by LINNÉ. Afterwards many other blue-ringed species got known, and the identification grew more and more difficult, owing to the fact that all subsequent authors used colours as distinguishing features. Difficulties are augmented by the results of genital examinations, because in this group the genitalia are so similar that they prove to be of little taxonomic value, so DOVER, examining the species of the British Museum on genitalia, even came to the conclusion that all blue-ringed bees of the East were merely subspecies of *zonata* LINNÉ. DOVER's speculations are, however, regarded as worthless by the author of this paper.

The author then enters into the morphology of the genus *Anthophora* LATR. After having dropped several structures as being worthless for discrimination the author eventually found that the decisive characters in this group lie in the apex of the abdomen; the 5th and 6th sternites being also helpful. A critical study of the 7th tergite in the male has revealed its value to taxonomy, so have the patting organs.

Nesting habits were studied, but nests appear to be rarely found, only ten nests having been observed in Australia. The architecture of the cradles varies much with the species. The cells are lined with a thin film of snow-white wax, which is a secretion and by microscopical investigation proved to have originally been a fluid. The time of development from egg to imago is still unknown, and the larvae are so delicate that the author has not yet succeeded in successfully rearing one to maturity.

Many interesting behaviours of the bees are next discussed. The insects, when flying, make a strong buzzing sound and are extremely restless; they have a preference for a long flower corolla. To ripen the nectar the females often sit in the hot sun. At night the males congregate about a tall dry grass stem, and, taking hold with their mandibles, rest throughout the night at right angles. The copulation never having been wit-

nessed adds a difficulty to associating the sexes of one species, and the author regrets not to be absolutely certain of every case, but when the structural details agree he has accepted the association to be right. From their disliking Composites and *Eucalyptus* flowers the author ventures to suggest that *Anthophora*'s of this group are Eastern of origin and have reached Australia at a comparative recent date. This is at some length also borne out by the fact that the number of species decreases towards the south of the continent.

There are several parasites known, the commonest enemies being the blue-spotted bees of the genus *Crocisa*. The parasites more or less act asinquilines of the *Anthophora* cells, as the parasite larva does not eat the whole of the food, resulting in a dwarf specimen of the rightful progeny. A Miltogramma fly, however, consumes the larval bee, in its larval state. The blue-banded bees are free from *Acarid* mites, the reason of this is unknown. A small insect of unknown affinities was found on the exterior of the tergites of *Anthophora engganensis*, and the larval pellicle of the insect was found in the body of a male bee from Sumatra.

The list of plants known to be visited by *Anthophora* species in Australia shows that these bees are especially fond of introduced flowers. An additional list for Java and Sumatra, arranged according to the plant families, was given to the author by Mr. M. A. LIEFTINCK from Buitenzorg; this list also contains many introduced forms, as indeed many of the common wild flowers hereabout were formerly introduced.

The series of species is opened by the description of two species which were difficult to place, the so-called Coppery and Green species, and two dubious intermediate forms, one of which appears to be baptized with a *nomen nudum*!

The real list starts with the *chlorocyanea* series, containing 8 species and two subspecies, six species of which and both subspecies appearing to be new.

Part II. The *pulchra* series, containing 12 new and 12 already known species, besides 4 new subspecies.

In an Addendum a new species of the *chlorocyanea* group is scantily diagnosed, the author being placed before the difficulty of having to associate some male specimens of a species of that group which were taken at the nest of *A. murrayensis*, a species of the *pulchra* series.

Part III. The *zonata* series, containing 15 new and 9 already known species, and 2 varieties, one of which is new.

It will draw the attention that many of the species have a wide area, and that apparently little difference is found between local forms of such widely separated habitats as for instance Poeloe Tello Is., Java, Celebes and North New Guinea, or that males from Java have been associated with females from Ceylon. This would suggest the splitting up into still

more species in the future, if the association proved to be wrong, or the discovery of the said species in all the intermediate countries. Some undescribed *Anthophora*'s from North India, and also from New Guinea, the latters being the results of the Archbold expedition, will probably be published afterwards in Part IV of this Revision.

All three manuscripts are accompanied by a large number of drawings, which will undoubtedly enlighten subsequent identifications, and may be used as a test concerning the validity of the newly created units.

MICROLEPIDOPTERA OF THE WISSEL LAKES,
WEST NEW GUINEA, I.

(8th Paper on Indo-Malayan and Papuan Microlepidoptera)

by

A. DIAKONOFF
Buitenzorg, Java.

The present paper is based on two collections of *Microlepidoptera* made in Central West New Guinea. The first lot was collected in 1938 by Mr. J. P. K. VAN EECHOU in the surroundings of Lake Paniai, the largest of the Wissel Lakes, the second collection was made in the same locality by Prof. Dr. H. BOSCHMA, the Zoologist of the LE ROUX expedition 1939. The localities of the second collection are Lake Paniai and Araboe bivouac, at altitudes of 1750 and 1800 metres respectively. This is a wet region of hills and mountains covered with dense forest and separated by lakes and swampy valleys.

The material is insufficient to make conclusions on the fauna, but it may be stated that pale coloured *Schoenotenes*-species, very typical for the mountain fauna of New Guinea, are represented by 4 species, but the elements of the coast and the low mountain regions are also present in the form of the large, blue coloured *Zacorisca holantha* MEYR. and the white *Z. spectabilis* nov. spec. of the *patarea* group.

The present paper deals with the family *Tortricidae*, of which one genus and 11 species are described as new. Other families will be dealt with in another paper.

The types are preserved temporarily in the Buitenzorg Museum.

Genus *Zacorisca* (MEYR., 1910) DIAK. 1940.

Dichromia FELDER, Novara Reise, pl. 239, fig. 29, 1875 (non descr.).

Zacorisca MEYRICK, Proc. Linn. Soc. N. S. Wales, vol. 35, p. 220, 1910.

Atteria MEYRICK nec WALKER, Proc. Linn. Soc. N. S. Wales, vol. 35, p. 221, 1910.

Megalodoris MEYRICK, Exot. Microl., vol. 1, p. 5, 1912.

Chresmarcha DIAKONOFF nec MEYRICK, Zool. Meded. Mus. Leiden, vol. 21, p. 135-142, 1939.

Zacorisca DIAKONOFF, Treubia vol. 18, p. 31, 1941.

In my above-cited paper the genera *Chresmarcha* and *Zacorisca* were fused together on account of the discovery that the neururation of „*Chresmarcha*” *pythia* is entirely like that in the males of typical *Zacorisca* species, e.g. *Z. holantha* MEYR. The strange features of the

males of *Chresmarcha delia* MEYR. and *Chr. sibyllina* MEYR., viz. veins 7 and 8 of fore-wings stalked and vein 3 from before angle, could not be explained at that time. However, I supposed that, maybe, similarly coloured species of two entirely different genera were placed by MEYRICK together in his genus *Chresmarcha*. As a proof for this opinion could serve striking differences in male genital characteristics between *pythia* and *sibyllina* (vide my paper, p. 138-139, fig. 3 C and p. 138, fig 3 E respectively). While the male genitalia of *pythia* belong to the distinct, specialised type, characteristic for the subfamily *Chresmarchides* and of which e.g. *holantha* is a typical representative, the male genital apparatus of *sibyllina* is typically Cacoeciid in character and shows a correlation with *Adoxophyes*.

Unfortunately, I could for several reasons not work out this point when writing my above-mentioned paper and I did not venture to publish my supposition at that time, awaiting further proof. There was, however, no doubt about the relation between brightly coloured *Zacorisca holantha*, *stephanitis*, *thiasodes* on the one side and white-and-black *Chresmarcha pythia* and *Chr. sibyllina* female on the other hand; therefore I could not maintain both these genera, and declared *Zacorisca* to be a synonym of *Chresmarcha*.

At present the lacking proof is acquired by the discovery of the true male of *sibyllina* and of an allied species, represented by both sexes, which is described below. Descriptions of a long series of other allied Papuan species will I hope soon follow. All these species are typical relatives of *holantha*, their males are in possession of a strong costal fold and have veins 7 and 8 in fore-wings separate, and vein 3 from angle.

At the same time the problem of *sibyllina* male and of *delphica* male is also solved. These two species have nothing to do with the other species mentioned and represent a quite distinct, bitypic genus *Chresmarcha*, with *sibyllina* MEYR. as genotype, belonging to the subfamily *Cacoeciades*, related to *Adoxophyes* MEYR. Both species show a striking imitation of the colouring of the *Zacorisca pythia* group: snow-white with black terminal and apical markings, preceded by a yellow suffusion. In the material of the 3rd ARCHBOLD Expedition I found also a Lithosiid and a Lymantriid with the same colouring! This striking character is rather common in the Papuan region, which has been noticed already by MEYRICK (T.E.S., vol. 87, p. 503, 1938).

The allies of *holantha* must be placed together in the genus *Zacorisca* MEYR., which was formerly rejected by me and is now re-established, in a quite different sense, however, then understood by MEYRICK. A series of brightly coloured species has been described already by MEYRICK; three new ones are added in the present paper. All the species possess the above-mentioned characteristics and, added to these, an especially

important feature: two areas on ventral surface of the 7th segment of abdomen in female are densely covered with short curly hairs, forming two pads with a rather smooth, velvety surface. To facilitate descriptions I give to these formations the name of *corethrogyne* (χόρημος = a brush, γυνή = a female). The scales can be easily removed; perhaps they serve for the covering of eggs or they may represent a scent organ. MEYRICK's name „genital vesicle” or „vesicular formations” (Exot. Microl., vol. 3, p. 111, 1924) cannot be maintained, as they are — properly speaking — no vesicles at all (perhaps they may be blown up and extended).

In consequence of the above-mentioned correction of nomenclature I change the subfamily name *Chresmarchidii* DIAK. in *Zacorisca*, nov. nom. with the genus *Zacorisca* as type.

Zacorisca holantha MEYR., 1910

MEYRICK, Proc. Linn. Soc. N. S. Wales, vol. 35, p. 221, 1910.

Chresmarcha holantha. DIAKONOFF, Meded. Zool. Mus. Leiden, vol. 21, p. 139, fig. 2 E, 3 A-B (genitalia).

C. West New Guinea, Lake Paniai, 20, 30. VIII; 6, 7, 10, 25, 28. IX. 1939. Araboe Camp, 4, 5, 8. X. 1939. (Prof. Dr. H. BOSCHMA).
3 ♂ 7 ♀.

Zacorisca tetrachroma nov. spec.

τέτρα- = four-, χρώμα = colour.

♀ 28-30 mm. Head and thorax deep indigo-blue, tegulae suffused greyish. Antennae deep indigo-blue at base, greyish posteriorly. Palpi rather long, S-shaped, somewhat roughish scaled, basal joint and lower half of medial whitish-yellowish, upper half of medial and entire terminal joint deep indigo-blue. Abdomen bronzy-fuscous-ochreous above, blackish beneath, anal tuft with lilac gloss, preanal areas ochreous-greyish anteriorly, grey posteriorly. Legs bronzy-fuscous-greyish, tibiae suffused purple-blackish at the outer side. Fore-wings with costa gradually arched anteriorly, straight posteriorly, apex rounded, termen straight, almost vertical. White and cuppery lilac-greyish. A streak at base, narrowly produced on base of costa, deep indigo-blue, a minute streak on base of dorsum grey; basal 1/4 or 1/3 of wing white, suffused on upper half of base and on costa with light yellow; posterior 2/3 of wing unicolorous lilac-grey with cuppery gloss, in one specimen an erect-triangular olive-grey, tornal patch, reaching about 4/5 across wing (disappeared in worn specimens). Cilia cuppery-lilac-ferruginous. Hind-wings brightly orange, paler at base, posterior 2/5 suffused reddish-fuscous, a narrow, suffused terminal streak of the same colour, dilated but less distinct in tornus; costal 1/5 white. Cilia light cuppery-ferruginous with darker antemedian line.

Genital apparatus ♂ (fig. 1). Mensis dorsalis and ventralis well developed. Scopa ventralis large, bilobed, with a double comb of fine hairs. Tegumen very large, and strong. Saccus strong, short, emarginate at the top. Valva of very complicated structure, semimembranous, with many folds, sacculus of intricate structure, of strong chitine, showing separation into a distal and a proximal part, bristled along the inner edge; valvula a small plate with acute lateral projection and a medial bristled knob. Uncus very broad, hooded, with two projections below the top and two peculiar pencils of long bristles, directed upwards and crossed, representing the socii. Gnathos strong, quadrate, with a short top and a curved medial appendix. Transtilla paired: a scobinate, erect projection at each side. Anellus ovate, strong. Aedoeagus moderate, rather narrow, little curved. Cornuti: a sheaf of long, flattened spines. (Slide No. 298 D).

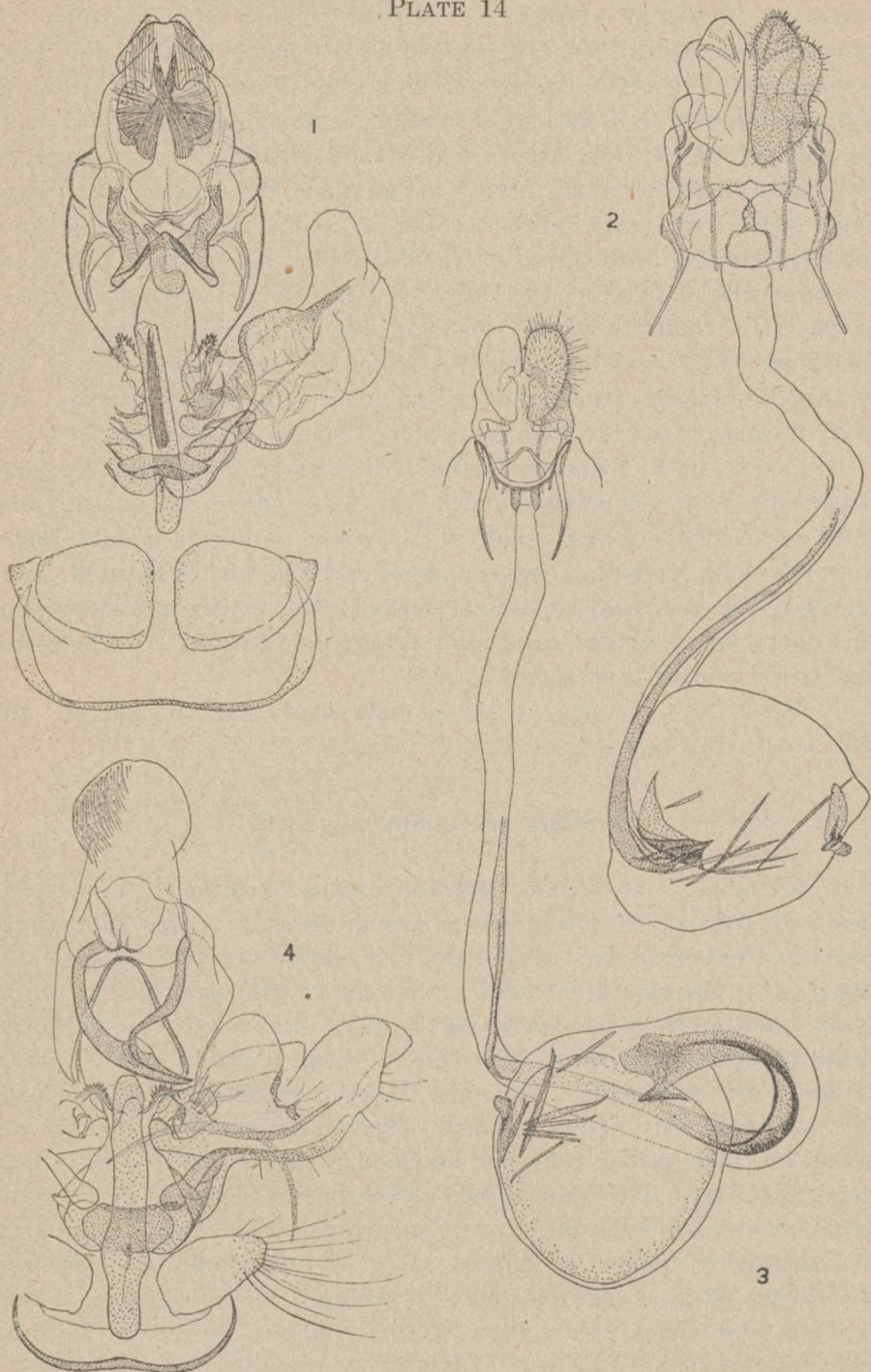
♀ Pl. 14, fig. 2. Ovipositor lobes of a peculiar shape: pointed below and beneath, with a medial, rounded lob. 8th segment chitinised. Limen formed by an ovate, elongate plate with a round ostium in middle. Ductus moderately long, cestum a narrow band, dilated and excavated below, connected with a strong, chitinised, beaked place in bursal wall; signum rather short, broad, obtuse, capitulum small (Slide No. 297 D). The cestum is not coiled and of a cacoeciad type.

C. West New Guinea, Lake Paniai, 4, 6, 14, 19, 28. X. 1939 (Prof. Dr. H. BOSCHMA) 1 ♂, 5 ♀.

Zacorisca spectabilis nov. spec.

♂ 26 mm, ♀ 30-32 mm. Head and scape of antennae light-yellow, tinged with whitish, in ♂ tinged with orange laterally; collar pale orange; flabellum of antennae dark grey. Palpi pale orange-yellow in ♂, yellowish-whitish in ♀, terminal joint with a few reddish-greyish scales at the tip. Thorax snow-white posteriorly, light-yellow anteriorly; methathoracic tergites blackish, dark grey from below, except a yellow collar; pleurae suffused with white scales. Abdomen dark brownish-grey, with a leaden shine, suffused with white at base, blackish-brown from below; anal segment in ♂ pale golden-ochreous, margins of valvae suffused with bright orange and edged with dark grey, corethropyne ochreous-grey, with a bright golden shine. Legs dark grey. Fore-wings rather broad, in ♂ a narrow fold reaching to before $\frac{1}{2}$, dilated along posterior half by long, white fringe along interior edge; costa in ♂ strongly curved at base, straight in middle, apex almost rectangular, slightly rounded, termen straight and vertical above, rounded beneath; costa in ♀ gradually but less curved at base than in ♂, slightly curved posteriorly, apex rounded, very slightly projecting, termen scarcely sinuate: slightly projecting below middle,

PLATE 14



Genital apparatus: Fig. 1, *Zacorisca tetrachroma* nov. spec. ♂. Fig. 2, ♀. Fig. 3, *Zacorisca capnoptera* nov. spec., ♀. Fig. 4, *Isotenes epiperca* nov. spec. ♂ (auct. delin.).

almost vertical. Snow-white at base, silvery-white on posterior $2/3$; base with a small pale-yellowish suffusion; termen and posterior $2/5$ of costa with common serrate marginal markings, jetty-black, serrations forming elongate triangles on lower half of termen, on apex and costa broadly connected; in ♂ a narrow blackish line reaching along costal edge towards base to $2/5$ of costa; costal fold slightly suffused with greyish; yellow, preterminal suffusion with anterior edge rather well defined, the latter running from middle of tornus to costa at about $4/5$, in ♂ concave. Cilia snow-white. Hind-wings blackish, paler towards base, black towards apex, cilia snow-white, basal third grey. Fore-wings from below with apical half more or less suffused with black (this blackish colouring changes the snow-white colour of upper side in silvery-white), basal half yellowish-white; hind-wings with posterior part variably suffused with black, elsewhere blackish, suffused with white.

Genital apparatus ♂ (fig. 5). Scopae very large, sc. ventralis: two brushes of long hairs inserted on a cup-shaped membranous plate on each side, sc. dorsalis a crown of hair-scales. Menses darkly chitinised, m. ventralis curved, m. dorsalis \perp -shaped. Tegumen large, erected, its base narrow. Saccus strong, ovate, with dilated arms and slightly indent base. Valva elongate, its disc membranous, strongly folded. Sacculus chitinised, narrow, haired. Valvula (?) a haired pad. Uncus subtriangular, apex rounded, somewhat dilated, at the ventral side britsly, with a curved thorn on each side. Socii: small, rounded projections with rather short hairs. Gnathos very strong, dark, with narrow arms and curved, rounded point. Transtilla paired: a Γ -shaped projection on each side, dentate proximally, its point smooth, obtuse. Anellus strong, subcordiform. Aedoeagus pistol-shaped, rectangularly bent, with projecting, chitinised lower edge of orifice vesica bilobed. Cornuti not perceptible. (Ductus ejaculatorius rather long, bursa seminalis with a coiled, narrow, chitinous rod in the wall. Slide No. 303 and 303a D, holotype).

♀ (fig. 6). Ovipositor lobes broad, dilated and rounded above. 8th segment chitinised. Ostium moderate, cup-shaped. Limen a small, somewhat curved, chitinous rod, with a short, sharp projection on each side. Colliculum strong, funnel-shaped. Ductus long, with a huge, broad and coiled cestum, which has a median rib (very typical feature). Bursa large, spheroid. Signum moderate, its blade broad, with minutely serrate edge, capitulum moderate. (Spermatophore perceptible, but no broken off cornuti of the male. Slide No. 304 D, paratype).

C. West of New Guinea, Lake Paniai, 23 - 24. IX. 1939 (Prof. Dr. H. BOSCHMA). 1 ♂, 2 ♀.

Of the *pythia*-group. Distinct by dark brownish-grey ventral surface of abdomen (in *pythia* white, in *delia* the abdomen light ochreous-

yellow throughout), by yellow palpi and extended yellow preterminal suffusion (in *patarea* palpi orange, black-tipped, yellow suffusion small, faint).

***Zacorisca capnoptera* nov. spec.**

Kαπρός = smoke *πτέρω* = wing

♀ 20 mm. Head, terminal joint of antennae and thorax brownish-black, face of head, palpi elsewhere and tegulae brightly yellow. Abdomen dark bronzy-brown, bright golden-ochreous. Thorax from below and legs dark bronzy-brown, the former with a few whitish scales. Fore-wings elongate-ovate, costa curved anteriorly, straight posteriorly, apex rounded, termen straight and vertical above, rounded and slightly projecting beneath. Evenly dark leaden-grey, faintly tinged ochreous, shining; base of wing, costa termen and base of dorsum narrowly suffused with black, this suffusion broader on termen, terminal veins thinly suffused with blackish along posterior half. Cilia snow-white, basal 1/3 black. Hind-wings dark leaden-grey, a little paler towards base, glossy, less shining than fore-wings; cilia snow-white, basal 1/3 black.

Genital apparatus ♀ (fig. 3). Ovipositor lobes broad, dilated and rounded above. 8th segment chitinised. Limen a U-shaped narrow rod with small lateral hooks. Colliculum strong, but short, cylindrical. Ductus long, cestum strong, broad below, forming a single large coil. Bursa spheroid. Signum small, with a short, broad, minutely serrate blade and small capitulum. (Spermatophore with a thick wall and broken off cornuti present. Slide No. 302 D, type).

C. West New Guinea, Lake Paniai, 12. IX, 1939 (Prof. Dr. H. BOSCHMA). 1 specimen.

***Zacorisca melanoleuca* nov. spec.**

μῆλας = black *λευχός* = white

♀ 20 — 23 mm. Head, palpi, scape of antennae and thorax anteriorly bright orange, terminal joint of palpi mostly suffused with brownish. Thorax white, when denuded appearing blackish, from below black, thinly covered with snow-white scales, legs pale orange-ochreous, suffused with greyish. Abdomen bright orange, somewhat suffused blackish at base above, anal segments and corethrogyne jet-black. Fore-wings elongate-subovate, costa curved anteriorly, straight posteriorly, apex rounded, termen straight above, rounded beneath, vertical. Considerably varying in colouring. 1st specimen: fore-wing snow-white, costa from beyond half to apex with short oblique, blackish streaks between veins decreasing in size towards apex; small, triangular, black terminal dots on veins, preceded

by small streaks of pale yellowish, scarcely running halfway towards cell. Cilia snow-white mixed on basal half with a few blackish scales. Underside of fore-wings white, suffused blackish along posterior half of costa and on terminal 1/3 of wing. Hind-wings white, apical half suffused blackish, this suffusion continued along anterior half of terminal edge, but not reaching dorsum. Cilia white, basal 1/3 greyish. 2nd specimen: Fore-wings snow-white, terminal 1/3 suffused dark blackish-grey, speckled with white scales; its anterior edge vertical on costa, slightly angulate below this, a little outwardly oblique from there to dorsum before tornus; dark marginal markings black, ill defined. Cilia snow-white, basal 1/3 grey. Under-side as in preceding, but dark parts black, light parts suffused with greyish. Hind-wings suffused with dark grey, turning blackish posteriorly, cilia as in preceding. 3rd specimen: fore-wings entirely suffused with dark leaden-grey, somewhat violet-shining, costal and terminal edge suffused with black streaks on terminal veins, reaching halfway to cell. Cilia snow-white, basal 1/3 dark grey. Under-side as in preceding, but yet more suffused with grey. Hind-wings and cilia as in preceding.

Genital apparatus ♀ (fig. 7). Ovipositor lobes moderate, upper edge rounded. 8th segment forming a strong, chitinised collar. Limen: a rectangularly bent rod with angular short projections at the sides and a bowed central part. Ostium broad. Colliculum a short, chitinised tube, membranous at the fore side. Ductus long, cestum a narrow band, beginning at about upper 1/4, coiled with the ductus twice around the bursa, ending in bursal wall in an elongate-triangular, rather large chitinous body with roughly serrate edge. Signum short, clavate, capitulum small (slide No. 299, 300 and 301 D).

C. West New Guinea, Lake Paniai, 8, 12 and 19. IX. 1939 (Prof. Dr. H. BOSCHMA). 3 ♀ At first sight these specimens seemed to belong to three different species. But close examination of head, of upper and under side of thorax and of abdomen¹⁾ revealed a near relation between the three specimens. The genitalia which are absolutely identical, prove that the three specimens are conspecific.

***Isotenes crobylota* (MEYR. 1910) DIAK. 1941.**

Harmologa crobylota MEYRICK, Proc. Linn. Soc. N. S. Wales, vol. 35, p. 270-271, 1910.

Piliscophora grisea DIAKONOFF, Zool. Meded. Mus. Leiden, vol. 21, p. 146, 1939.

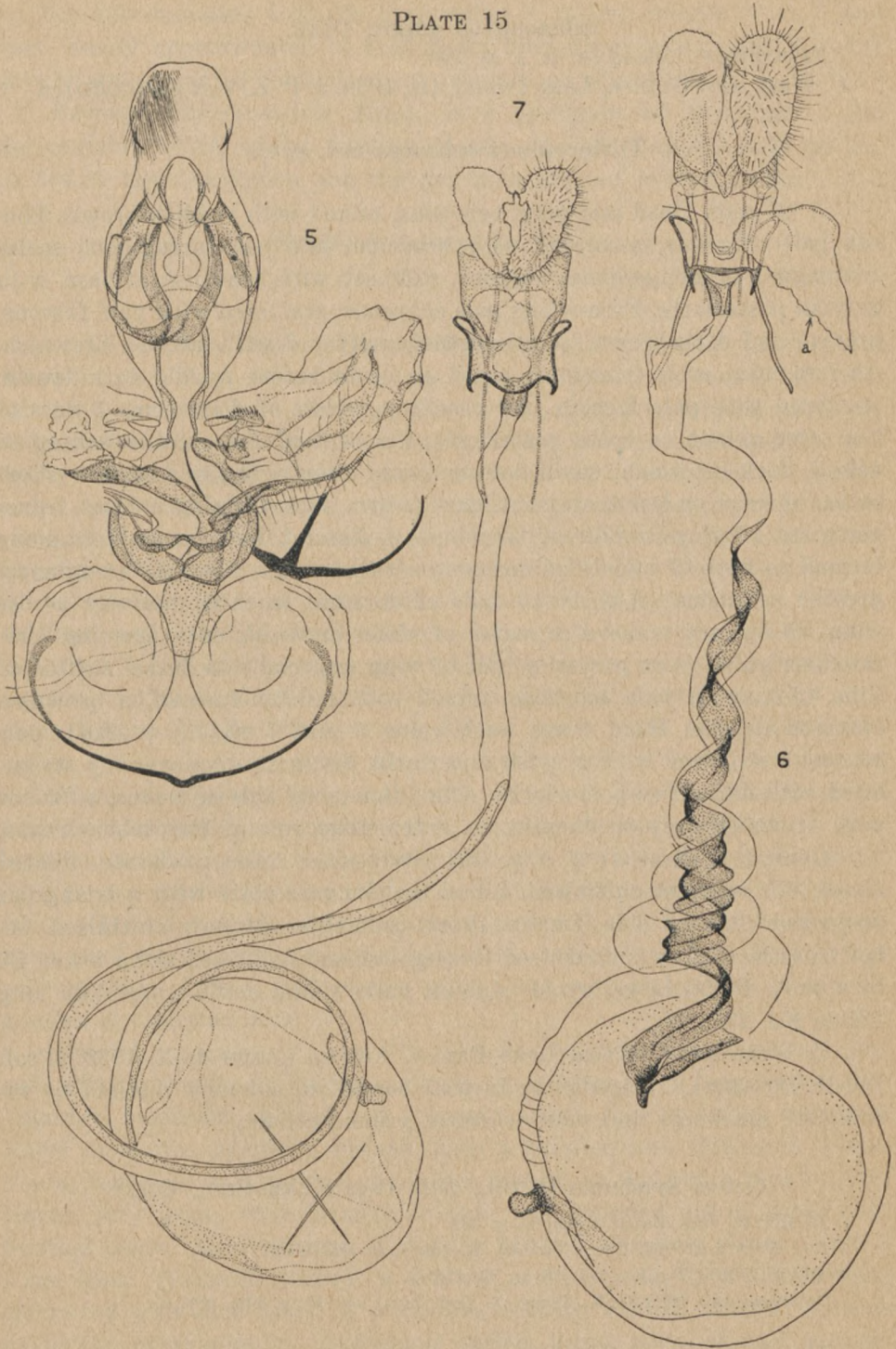
C. West New Guinea, Lake Paniai, IX, 1938. (J. P. K. VAN EECHOU),

1 ♂.

¹⁾ The colouring of these parts is of the greatest importance for the discrimination of *Zacorisca*-species, as I have endeavoured recently.

C. West New Guinea, Lake Paniai, IX. 1938. (J. P. K. VAN EECHOUD). 1 specimen. Distinct by ferruginous and brownish scaling. According to genitalia and other characters doubtlessly belongs to this genus, in spite of veins 6 and 7 in hind-wings being approximated at base and not connate.

PLATE 15



Genital apparatus: Fig. 5, *Zacorisca spectabilis* nov. spec. ♂. Fig. 6, ♀. Fig. 7, *Zacorisca melano-leuca* nov. spec., ♀ (auct. delin.).

Adoxophyes aniara DIAK.

DIAKONOFF, Treubia, vol. 18, p. 36, 1941.

C. West New Guinea, Lake Paniai, IX, 1938. J. P. K. VAN EECHOUDE). 1 ♂.

Thrincochloa ochracea nov. spec.

♀ 27 mm. Head and palpi ochreous, mixed with reddish-brown. Thorax pale ochreous, scattered with brownish and pale-ferruginous scales (damaged). Abdomen pale ochreous, suffused with brownish at base, with greyish posteriorly. Fore-wings pale ochreous, scattered with pale fuscous, greyish and dark brown scales, partially suffused with greyish-brownish. An irregular, erect-triangular patch on costa before middle dark brown, scattered with pale fuscous, not reaching middle of disc; some 3 dots of the same colour on costa posteriorly, the central one erect, reaching to vein 7, dark brownish, small dots on costa anteriorly; an irregular short series of more or less coalescent, dark brown dots, forming a short transverse strak before middle of termen, less distinct dark brown dots along termen to beyond middle of dorsum; a rather dark fuscous-ferruginous-greyish suffusion on posterior half of dorsum, reaching halfway across wing; ill defined transverse series of violet-brownish dots, forming irrorated strigulation on posterior half of wing, especially in dorsal suffusion. Cilia (damaged) pale ochreous, mixed with reddish-fuscous, a brownish antemedian line. Hind-wings with veins 6 and 7 shortly stalked, pale ochreous, suffused with greyish anteriorly, distinctly transversely strigulated with dark grey posteriorly; cilia (damaged) pale ochreous, suffused with brownish-grey on dorsum, an antemedian row of brownish streaks.

Genital apparatus ♀ (fig. 10). Ovipositor lobes moderate, dilated above. 8th segment chitinised. Limen an elongate plate with a triangular projection on each side. Ductus short, colliculum strongly chitinised, below this the ductus is chitinised throughout and is dilated along lower 1/5 to a sack. Bursa large, ovoid, signum narrow and acute, capitulum long (Slide No. 296a D).

C. West New Guinea, Lake Paniai, Araboe Camp, 4. X. 1939 (Prof. Dr. H. BOSCHMA). 1 specimen. In poor condition, but very distinct by incomplete markings and pale ochreous ground-colour.

Genus *Syndemis* HÜBN., 1826 (nec HERR.-SCH., 1851)

HÜBNER, Verz. Europ. Schmett., p. 382.

(nec *Tortrix* LINNE, Syst. Nat., ed. X, vol. 1, p. 496, 1758).

DIAKONOFF, Treubia, vol. 18, p. 39, 1941.

? *Ctenopseustis* MEYRICK, Trans. N. Zeal. Inst., vol. 17, p. 146, 1885.

The diagnosis of this genus, as given in my paper cited above, may be completed as follows: fore-wings with vein 2 from about $1\frac{1}{2}$, 3 - 5 more

or less approximated towards base, often 4 rather remote from 3 and very closely approximated to 5 at base; hind-wings with veins 6 and 7 closely approximated towards apex, connate or shortstalked.

Perhaps *Ctenopseustis* MEYR. is a synonym of this, but I am not certain of this, as the position of veins 2-5 in fore-wings is not recorded in the description and the genitalia are not known to me.

***Syndemis tetrops* nov. spec.**

$\tau\epsilon\tau\rho\alpha =$ four-, $\delta\psi =$ eye.

δ 16-18 mm. Head, palpi and thorax greyish-ochreous, medial joint of palpi with long ochreous fingers at apex above. Abdomen greyish-ochreous, anal tuft pale ochreous. Fore-wings dilated to middle, edges parallel posteriorly, costa with moderately broad fold to before middle, gradually curved along this, with a small scale-tuft at its end, straight posteriorly, roughened with scales towards apex, apex rounded, termen almost straight above, rounded beneath, little oblique. Shining light ochreous, tinged greyish, scattered with fuscous scales, suffused with brown. Brownish suffusion on base of costa; transverse fascia indicated by an oblique, suffused, wedgeshaped, small patch on costa at $2/3$, interrupted below costa, indistinct below and reaching about halfway across wing and by a very distinct, suffused, dark brown, rounded dark in middle of wing just above fold; a smaller, dark brown dot on lower angle of cell; suffused brown streaks between veins along posterior half of costa, forming an indication of a triangular costal patch at about $1/4$ of costa; series of brown scales between terminal veins, forming narrow strigulae, turning little perceptible below half of terminal area towards tornus; a narrow dark brown suffusion along central half of dorsum, centre of disc somewhat suffused with brighter ochreous-brownish. Cilia light ochreous, paler posteriorly, an interrupted, brownish antemedian line. Hind-wings pale greyish, darker posteriorly; cilia dirty whitish-greyish, a cloudy, greyish antemedian line.

Genital apparatus δ (fig. 11). Mensis ventralis curved, mensis dorsalis strong, T-shaped. Scopa ventralis: two patches of long hair-scales. Tegumen moderate, dilated and truncate above. Saccus small, flattened. Valva moderate, elongate, plicate, with a bristled and chitinised dilatation at base. Sacculus narrow, chitinised, densely covered with fine bristles. Uncus very large, with triangular base and rounded apical projection, bristled below. Socii: groups of minute bristles. Gnathos strong, with a large hook. Transtilla paired: a dentate projection on each side, almost connected with each other by a narrow, dentate, median process. Anellus moderate, subtriangular. Aedoeagus rather large, pistol-shaped, cornuti a sheaf of long, strong spines (Slide No. 288 D).

C. West New Guinea, Lake Paniai, Araboe Camp, 6, 7, 12. X. 1939
(Prof. Dr. H. BOSCHMA). 6 ♂.

Syndemis erythrothorax nov. spec.

$\varepsilon \rho \nu \sigma \rho \delta \zeta$ = red.

♂ 20 mm. Head and thorax ferruginous, mixed with rosy-whitish scales, tips of tegulae and of thorax light rosy-whitish, tinged greyish. Palpi rather short, very densely scaled towards apex of medial joint, terminal joint very short, reddish-fuscous on basal half, greyish-brownish apically. Abdomen grey, suffused dark grey posteriorly. Fore-wings roughly scaled, an elongate, oblique tuft on base of wing below fold, costa roughish and thickened with scales, strongly curved at base, almost straight posteriorly, apex obtuse, termen almost straight above, rounded beneath, little oblique. Light greyish-whitish, very faintly tinged with pinkish, tips of scales ferruginous, giving rise to a pinkish-ferruginous suffusion along basal $3/4$ of wing, glossy. Markings brightly ferruginous, edged dark ferruginous. Basal area with posterior edge somewhat undulate, well defined, oblique, from costa beyond base to just below $2/5$ of fold, indent below costa and above fold; basal area suffused reddish-ferruginous, except on dorsum, on base of costa dark greyish, a reddish-ferruginous, narrow streak along fold; an obliquely-longitudinal, brownish scale tuft on base of wing below fold; transverse fascia indicated by a narrow, oblique, reddish-ferruginous, undulate fascia from $1/3$ of costa to middle of fold, well-defined anteriorly, connected posteriorly by slight, reddish suffusion with another such fascia from costa to beyond $1/3$, running halfway across wing, costal patch triangular, indistinct along costa, its top forming a small, reddish patch on upper angle of cell, connected by a narrow, straight strigula with middle of costa (being the anterior edge of costal patch), and by a short, minute line with a suffused, reddish-ochreous dot in middle of disc at $3/5$; faint, longitudinal suffusion between the latter and transverse fascia; a somewhat curved, vertical series of black dots, arising from termen above tornus and reaching to vein 7, two more black dots on this vein: in disc and before apex; reddish-brownish, triangular, suffused patches along costa, a light brownish suffusion along dorsum, speckled with dark brown; markings mixed with a few black scales, especially along edges; a few blackish points in apex and along termen above. Cilia pale greyish-white, mixed with light ferruginous-brownish, barred along basal $1/2$ with darker fuscous. Hind-wings brownish-grey, cilia paler, with a grey, antemedian line and whitish base.

Genital apparatus ♂ (fig. 9). Mensis ventralis large, bowed, mensis dorsalis a narrow, straight rod. Scopa ventralis two membranous, scaled lobes not figured. Tegumen rounded above, with strong pedicels, saccus

obviously absent. Valva of very peculiar shape: costa and sacculus chitinated, bristled along the inner edge and dilated before middle, at this place touching each other and forming in this way an laying-x-shaped body; apex of valva membranous. Uncus moderate, curved, dilated apically. Socii small, bristled knobs. Gnathos moderate, strong, curved. Transstilla very peculiar: paired, each half forming a flattened, chitinated body, scobinated at the top, which lays on costa and forms a whole with it. Anellus strong, elongate, narrowed in middle, thickened in centre. Aedoeagus large, little curved. Cornuti a sheaf of huge spines (Slide No. 289 D).

C. West New Guinea, Lake Paniai, Araboe Camp, 16. X. 1939 (Prof. Dr. H. BOSCHMA). 1 specimen.

Diadelomorpha nov. gen. (fig. 8).

$\sigma c \alpha \delta \eta \lambda o \varsigma$ = very clear, $\mu o \rho \rho \eta$ = shape

Ocelli posterior. Head with roughly appressed scales, projecting forward between antennae. Antennae slightly serrulate, shortly ciliate. Palpi rather long, porrected, somewhat curved downward, medial joint triangularly dilated by rough projecting scales above, terminal joint moderate, obtuse. Thorax with a double, posterior crest, tegulae narrow, beyond $1/2$. Fore-wings elongate, without scale-tufts, costa strongly sinuate, with a patch of projecting scales before middle. 2 from beyond middle, 3 strongly curved at base, from angle, 4 also curved, remote, little approximated towards angle, 5 remote, parallel to 6, 6 from below angle, 7 from angle, to costa, along basal $1/3$ nearly approximated to 8, 9 remote, 10 from $3/5$, 11 from before middle. Hind-wings without cubital pecten, with costa sinuate, subtrapezoid, 2 from before $4/5$, 3 and 4 stalked, from angle, 5 remote, somewhat approximated at base, 6 and 7 long-stalked.

Genotype *undulans* nov. spec., ♀.

An interesting form of the *Peronea*-group, differing from the latter by absence of scale-tufts and stalked veins 6 and 7 in hind-wings, from *Gymnidomorpha* TURN. by crested thorax and stalked veins 3 and 4 in hind-wings.

Diadelomorpha undulans nov. spec.

♀ 13,5 mm. Head (fig. 8) olive-grey, suffused with ferruginous, face ferruginous, lower part pale ochreous. Scape of antennae ochreous, tips dark ferruginous. Palpi long, reddish-ferruginous, fringe on lower and upper edge light ochreous, mixed with dark brownish, terminal joint ochreous. Thorax dark violet-ferruginous, posterior crest large. Abdomen dark grey, basal $1/3$ light ochreous, shining. Fore-wings with costa

strongly arched anteriorly, deeply sinuate posteriorly, curved before apex, apex rounded-pointed, termen slightly rounded above, very broadly rounded beneath, oblique. Dark ferruginous-violet, markings bright ochreous and dark ferruginous. A dark patch of scales on costa at $2/5$ (damaged); darker violet suffusion at base of this and along fold, reaching to dorsum at base of wing; the latter suffusion is edged from below by a dark ferruginous streak on base of dorsum, and by a suffused, reddish-ferruginous curved line from $1/5$ of dorsum

to fold before middle and then along fold to dorsum before tornus; thus a semioval patch of ground-colour resulting on dorsum, scattered with ochreous; a dark violet-ferruginous, obliquely-triangular costal patch; its anterior edge very oblique, from costa beyond middle to middle of termen, narrowly edged with bright ochreous and minutely edged with reddish-ferruginous, indented in middle, its posterior edge almost vertical, followed by small bright-ochreous area dotted ferruginous; some two minute, ochreous, transverse strigulae in tornus; on costa this patch bears two small, irregular, dark

ferruginous triangular dots edged with ochreous, first of these connected by an ochreous strigula with indentation of the anterior edge of costal patch. Cilia ochreous, mixed in apex, and irregularly barred along termen ferruginous, a suffused dark grey bar in tornus. Hind-wings ochreous-brownish, lighter towards base, darker posteriorly, shining; cilia ochreous-brownish, with a sharp, whitish basal line.

Genital apparatus ♀ (fig. 12). Ovipositor lobes elongate. Ostium: a short, truncate funnel, a small angulate projection on each side of it. Ductus short, not chitinised, bursa paired: a broader, pear-shaped upper and an elongate, clavate lower sac, communicating above (perhaps the upper sac is receptaculum seminis which makes a whole with the bursa), its wall unarmed, no signum. (Slide No. 295 D).

C. West New Guinea, Lake Paniai, 10. IX. 1939. (Prof. Dr. H. BOSCHMA). 1 specimen.

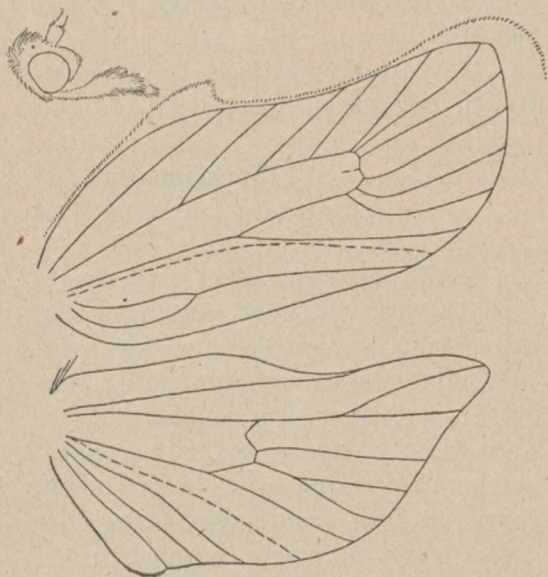
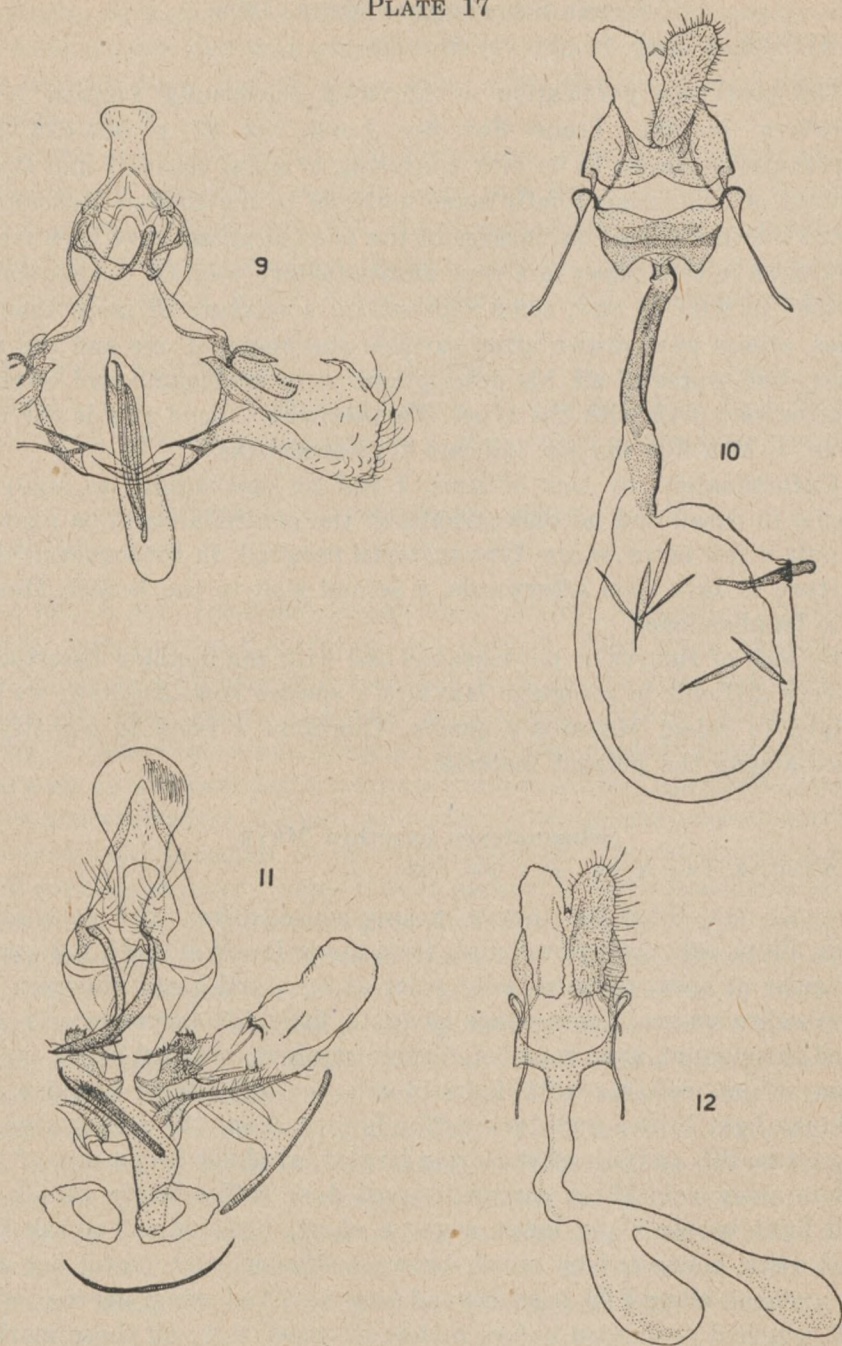


Fig. 8, *Diadelomorpha undulans* nov. gen., nov. spec., ♀, head and wing neuration.

PLATE 17



Genital apparatus: Fig. 9, *Syndemis erythrothorax* nov. spec. ♂. Fig. 10, *Thrinophora ochracea* nov. spec., ♀. Fig. 11, *Syndemis tetrops* nov. spec., ♂. Fig. 12, *Diadelomorpha undulans* nov. spec., ♀ (auct. delin.).

Genus *Schoenotenes* MEYR. 1908.

MEYRICK, J. Bomb. Nat. Soc., vol. 18, p. 619.

The posthume publication of MEYRICK concerning Papuan *Microlepidoptera* in the Trans. Ent. Soc. Lond., vol. 87, p. 503-528, 1938, unfortunately appears to be very confusing in some places. I had the opportunity of examining briefly some material in the British Museum and came to the conclusion that species of the present genus have been treated by MEYRICK in that paper in a very unsatisfactory way. Of the six species, described by him as new, some represented a mixture of more than one species, others were drawn after variable specimens of one and the same species; but, worse of all, his descriptions were inadequate and often did not agree very well with the types. Furthermore — and this is the usual trouble — MEYRICK did not indicate type-specimens.

Unfortunately, by lack of time, I had no opportunity to study the material in detail and no photographs of the genitalia could be made. So that only a few notes on the type-material resulted. In consequence of my departure to Java soon afterwards, a second visit to the British Museum had to be abandoned.

By lack of figures or photographs and with the puzzling descriptions, it is very difficult to recognize MEYRICK's species now. Anyhow, we have no right to reject MEYRICK's names. Therefore I tried to identify his species among the present material.

Schoenotenes exarthra MEYR.

MEYRICK, Exot. MicroL., vol. 2, 169, 1918.

♀ 21 mm. Head and thorax creamy-white, mixed with dark coffee-brown. Palpi pale coffee-brownish, base along lower side whitish, medial joint paler at apex, terminal joint paler at apex and base. Abdomen light bronzy-ochreous-grey. Fore-wings elongate, little dilated posteriorly, costa curved throughout, apex rounded, termen straight, rounded below, oblique. Creamy-white, retinate with light brown, scattered with blackish dots, markings light brown and dark coffee-brown. About 10 dark brown dots along costa, 8th and 9th of these the largest, at about $\frac{3}{4}$; a row of smaller dots along vein 12; a narrow, curved dark coffee-brown streak, suffused light brown along lower edge; a short, longitudinal streak below $\frac{3}{4}$ of costa, connected by small, brown suffusion with costal dot above this, a streak along fold from beyond base to $\frac{1}{3}$ of wing, narrow, with a small, rounded projection before middle of upper side: all these markings dark coffee-brown; a blotch before central $\frac{1}{3}$ of termen, another such blotch, but curved, narrower, from dorsum before tornus reaching across wing to vein 5: both blotches light brown, edged with dark brown dots on veins; some irregular, dark dotting in middle of disc and in fold

posteriorly; termen with a narrow, light brown line. Cilia creamy-white, barred along lower half with greyish-brown. Hind-wings greyish-brownish, paler towards base, darker along edge; cilia whitish, tinged with pale brownish.

Genital apparatus ♀ (fig. 16). Ovipositor lobes hairy, rather narrow-rheniform. 8th abdominal segment hairy and finely scobinate, forming a ventral, curved pad on each side. Apophyses short. Limen a sinuate rod, dilated before its extremities. Ostium narrow, colliculum membranous, cestum rather broad, coiled. Bursa moderate, ovoid, unarmed. (Slide No. 291a D).

C. West New Guinea, Lake Paniai, 15. IX. 1939 (Prof. Dr. H. BOSCHMA). 1 ♀. A very distinct species. It was described from Setakwa River, South New Guinea (I possess a photograph of the type specimen).

***Schoenotenes subcroceata* MEYR., 1938.**

MEYRICK, Trans. Ent. Soc. Lond., vol. 87, p. 508.

♂ 18 - 19 mm. Head and thorax dirty whitish, somewhat mixed with greyish, vertex of head suffused with greyish. Palpi white, medial joint along upper side of base and terminal joint except apex suffused with greyish or dark grey. Abdomen snow-white, slightly suffused pale greyish at base. Fore-wings elongate, moderately dilated posteriorly, costa moderately curved anteriorly, more curved before apex, apex little rounded, termen almost straight, oblique, white, faintly strigulate between markings with pale olive-greenish or greenish-yellowish; markings olive-green, tinged greyish, narrowly edged a little darker, in worn specimens turning yellowish. A row of dark olive-grey dots along costa, larger posteriorly, smaller dots along dorsum; three transverse fasciae: from before $1/4$, from beyond $2/5$ and from $3/4$ of costa to $1/5$ of dorsum, to dorsum beyond middle and to dorsum before tornus respectively; first fascia darker, triangularly dilated and twice as broad on dorsum as on costa; second fascia constricted twice: below costa and above fold, its central portion rounded and projecting anteriorly; third fascia interrupted below costa (forming a round costal patch), constricted at lower $1/3$, less oblique, but as broad as preceding; a somewhat sinuate fourth fascia preterminal, from termen above tornus, not reaching apex, as broad as two preceding a small dots in tornus; cilia white, barred along costa and on basal half along termen with greyish (damaged). Hind-wings and cilia snow-white.

Genital apparatus ♂ (fig. 13). Scopa absent, mensis dorsalis small rod, dilated in middle. Tegumen strong, elongate. Saccus strong. Valva with costa and sacculus chitinised, the latter dilated at base and bristled along outer edge; apex of costa curved and densely covered with strong,

flattened, furcate bristles; at the apical edge some three bluntly pointed and one acute spines. Uncus very complicated: a haired apical lob ending in a thorn, two curved processes at base of this, dentate at the top, a pair of large blunt hooks below these processes, with two membranous processes on their base. (Perhaps these are the hairless socii). Gnathos paired, with scobinated arms. Transtilla paired: a small, strong plate at the base of costa. Anellus strong, trapezoid. Aedoeagus narrow, long, strongly curved, ending in a narrow, sharp spine above and a small spine below the orifice. (Slide No. 293 D).

C. West New Guinea, Lake Paniai, Araboe Camp, 8, 14. X. 1939 (Prof. Dr. H. BOSCHMA). 2 ♂. Described from Mt. Tafa, 8500 feet and Mafulu, 4000 feet.

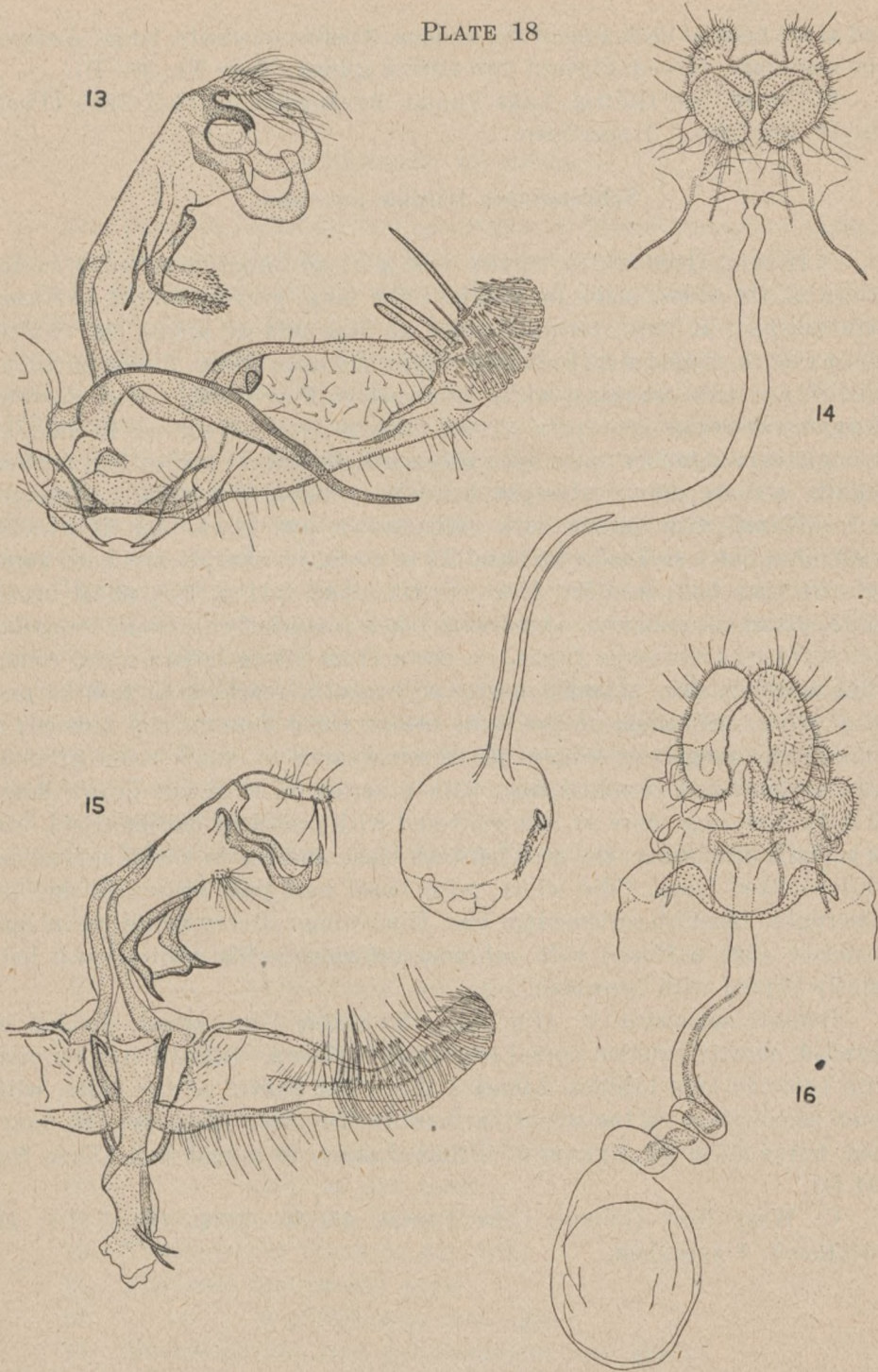
Schoenotenes arachnodes nov. spec.

ἀραχνοειδὲς = like a spider's web.

♂ 19 mm. Head and palpi whitish, basal half of medial joint suffused with brownish, basal half of terminal brownish-greyish. Antennae tinged with ochreous. Thorax whitish, suffused with light-greyish, abdomen dirty whitish, anal tuft white. Fore-wings elongate ovate, costa considerably curved at base and before apex, less curved in middle, apex rounded, termen very slightly concave above, rounded beneath, somewhat oblique. Snow-white, markings light grey and brownish-grey. Costa with a suffused brownish-grey spot at base, followed by some 7 smaller dots along costa, interchanging with minute points; a rounded-ovate, oblique spot at 1/3 of disc, very narrowly edged anteriorly with blackish, sharply edged elsewhere except from below, almost connected with 2nd costal spot; a series of elongate, irregular patches from out 3rd costal dot running obliquely to middle of disc at about 1/4, forming here a rounded, light grey patch, ending in an elongate, somewhat oblique fascia, from dorsum before tornus reaching to vein 4; a small, irregular mark below costa at 3/4, connected with 6th costal dot; an undulate, preterminal fascia from tornus, reaching to vein 8; fine, interrupted, light grey transverse strigulation, dark grey in fold, more distinct and suffused, brownish-grey on dorsum; terminal line formed by a series of narrow strigulae. Cilia white, an antemedian series of blackish marks. Hind-wings and cilia white.

Genital apparatus ♂ (fig. 15). Scopa absent. Tegumen elongate, saccus rounded, rather long. Valva elongate, narrow, curved, densely covered along posterior half with simple and furcate bristles, one or two spines at about middle of disc; costa chitinised, narrow, sacculus bristled, dilated at base. Uncus with a long, haired, apical process and two large hooks at its base. Socii: haired pads. Gnathos quadrate, two lateral spines and a medial, short hook. Transtilla not perceptible. Peniculi present: a strong, angularly bent

PLATE 18



Genital apparatus: Fig. 13, *Schoenotenes subcroceata* MEYR., ♂. Fig. 14, *Schoenotenes tricolor* nov. spec., ♀. Fig. 15, *Schoenotenes arachnodes* nov. spec. ♂. Fig. 16, *Schoenotenes escarthra* MEYR., ♀ (aust. delin.).

and acute hook at each side of the anellus. Anellus quadrate, large. Aedoeagus moderate, curved. Cornuti two strong spines (Slide No. 292 D).

C. West New Guinea, Lake Paniai, Araboe Camp, 14-X-1939 (Prof. Dr. H. BOSCHMA). 1 specimen.

Schoenotenes tricolor nov. spec.

♀ 16 mm. Head white, vertex with a broad longitudinal band cocoa-brown at the sides, black in middle. Palpi long, greyish-brown, suffused with blackish at base, terminal joint at base and at apical half white. Thorax black, tinged with brownish, edges and apex white. Abdomen dirty-whitish and pale ochreous, white from below. Fore-wings rather narrow, elongate-subtriangular, costa curved anteriorly, less curved in middle, strongly curved before apex, apex sub-acute, somewhat projecting, termen slightly sinuate above, straight beneath, oblique. Snow-white, retinate and suffused with rather dark cocoa-brown and black. An ill-defined, triangular, black suffusion on basal $2/5$ of costa, its sharply produced point not reaching fold; a short, black streak along fold at $2/5$; plical brush white, discal cocoa-brown, edged with black posteriorly; a broad irregular and suffused transverse fascia, on costa from $2/5$ to before apex, somewhat undulate disc, strongly narrowed beneath, reaching to fold beyond $1/2$ of wing; retination of the same colour along dorsum and termen; a transverse, irregularly edged, preterminal area of snow-white ground-colour, apical and terminal edge with a series of confluent brown dots; all dark markings more or less scattered with scales on darker parts, viz. on costal half of wing; the area between black and brown costal suffusions white, dotted black. Cilia white, with basal half pale brownish, and an interrupted blackish antemedian line. Hind-wings silvery-white, veins and posterior edge suffused with ochreous-brownish; cilia white, basal half faintly barred with brownish.

Genital apparatus ♀ (fig. 14). Ovipositor lobes small, divided in rounded, shortly bristled dorsal lobes and reniform ventral lobes, covered with common long bristles. Limen a thin plate curved at the sides, with small scobination on the upper surface. Ductus very long, narrow, unarmed, bursa spheroid, signum a chitinated patch in bursal wall (Slide No. 294 D).

C. West New Guinea, Lake Paniai, 15. X. 1939. (Prof. Dr. H. BOSCHMA). 1 specimen.

SUMMARY BY EDITOR

This paper is based on two collections of Microlepidoptera made in central West New Guinea, the first lot being collected in 1938 by Mr. J. P. K. VAN EECHOUD in the surroundings of Lake Paniai, the largest of the Wissel Lakes, the second in the same locality by Prof. Dr. H. BOSCHMA, the zoologist of the Le Roux Expedition 1939. The localities of this second collection are Lake Paniai and Araboe Bivouac, at altitudes of 1750 and 1800 metres, respectively, and both situated in a wet region of mountains covered with dense forest on the slopes, the valleys being swampy.

The author states that typical mountain elements of New Guinea, the pale-coloured *Schoenotenes* species occur mixedly with elements of the coast and low-mountain regions, e.g. the bright *Zacorisca holantha* MEYR.

The present paper deals with the family Tortricidae only, of which one new genus and eleven new species are described, the types being preserved in the Buitenzorg Museum.

The author then introduces a new subfamily name: *Zacoriscides*, type gen. *Zacorisca* MEYR., instead of *Chresmarchidii* DIAK., the genus *Chresmarcha* MEYR., with *sibyllina* MEYR. as genotype, being now included in the subfamily *Cacoeciades*. It was the discovery of the ♂ *sibyllina* which led to this conclusion.

The following genera and species have been enumerated, and the new ones described:

1. *Zacorisca holantha* MEYR. 1910
2. — *tetrachroma* nov. spec.
3. — *spectabilis* nov. spec.
4. — *capnoptera* nov. spec.
5. — *melanoleuca* nov. spec.
6. *Isotenes crobylota* (MEYR. 1910) DIAK. 1941
7. — *halirrhothia* (MEYR. 1938)
8. — *epiperca* nov. spec.
9. *Adoxophyes aniara* DIAK. 1941
10. *Thrincophora ochracea* nov. spec.
11. *Syndemis tetrops* nov. spec.
12. — *erythrothorax* nov. spec.
13. *Diadelomorpha* nov. gen. *undulans* nov. spec.
14. *Schoenotenes exarthra* MEYR. 1918
15. — *suberoceata* MEYR. 1938

16. — *arachnodes* nov. spec.
17. — *tricolor* nov. spec.

The text is accompanied by sixteen figures representing the genital apparatus of the new and of some of MEYRICK's species, and in the case of the newly described genus, a figure of the female wing and its wing neuration.

SOME MALAYSIAN BEES OF THE FAMILY ANTHOPHORIDAE

(Hym., Apoidea).

by

M. A. LIEFTINCK

(Zoological Museum, Buitenzorg)

(with 1 plate and 79 figures).

This paper is represented in the hope that it may serve to identify a number of Malaysian Anthophorid bees. Until recently almost no work has been done on the male genitalia of species belonging to this family of bees. RAYMENT, in this Journal, vol. 18, 1942, pp. 621-647, has started a thorough investigation of the *zonata* group of *Anthophora* and based his new species primarily on characters of the male and female genital organs. In this respect RAYMENT's work has had considerable influence on the present paper as it stimulated me to investigate the microscopical apical abdominal sternites and phallic organs of the males of all Malaysian species that came under my notice. Beyond expectation, however, — thus, for instance, in closely allied species of the *Anthophora insularis* group — it became soon evident that the specific differences in the male genitalia and minute apical sternites, although being very constant within the limits of a single species, are so slight as to be of little practical value, even to the specialist, in discriminating the species. Yet, a careful study of these delicate structures offers the decided advantage of throwing more light upon the mutual relationships of the species, paving the way to a more natural classification of species-groups in the future, especially if our knowledge of the many imperfectly diagnosed forms becomes equally complete; and, secondly, because these essential structures remain unchanged and hence can be safely relied upon when other characters become obsolete, as they frequently do in badly worn or old individuals, whose colours have lost their freshness and in which the pile is rubbed off.

The verbal descriptions of the genitalia and supporting organs are in most instances omitted from the descriptions as the figures show the differences clearly and are much more intelligible than descriptions.

The relations of Malaysian bees to the flowers they visit have been very little studied and the subject offers a rich opportunity for biological observations. It is very obvious that many of the rarer forest-loving Anthophorids are entirely dependent on certain kinds of flowers and an

extensive morphological study of both flowers and bees would doubtless throw fresh light on the question which flowers peculiar to dense primeval forest are dependent on bees for cross-fertilisation and which are not. The enormous length of the tongue and labial palpi of the *Anthophoridae* is well suited to getting food from long, slender flowers ¹⁾, and in respect to adaptation this development in several instances is indeed very convincing.

It is my hope that the few notes included in this paper on plants visited by these bees may contribute in some small measure to solving this interesting problem.

The line-drawings illustrating this paper are original camera lucida sketches, the fine photographs were made by Messrs. H. & F. HUIJSMANS.

I wish to express my appreciation and thanks to my friend Dr. J. VAN DER VECHT for the loan of several interesting specimens in his private collection and for the privilege of studying them.

Unless otherwise specified the types of the new species as well as the other specimens are located in the collection of the Buitenzorg Museum.

Subfam. MELECTINAE.

Genus *Callomelecta* COCKERELL.

1926. COCKERELL, Ann. Mag. Nat. Hist. (9) 18. p. 621.

1929. COCKERELL, Ibid. (10) 4, p. 133 (note).

In the following pages descriptions are given of three species of *Callomelecta* CKLL, two of these being apparently new to science. Mr. H. M. PENDLEBURY kindly forwarded to me a male and female each of *C. pendleburyi* CKLL, the ♂ of which had not so far been described. The material now available for study enables me to deal more fully with this genus than could be done by Professor COCKERELL.

As has been pointed out by LINSLEY (*Ann. Ent. Soc. America*, 32, 1939, p. 429-433), many genera of parasitic bees placed by some authors in the *Nomadidae*, or treated by others as a separate family, the *Melectidae*, are better placed in a subfamily of the *Anthophoridae*, the *Melectinae*. The latter alternative seems most in accord with our present knowledge of the group as the melectine bees differ markedly from the *Nomadidae* in wing structure. LINSLEY has shown that the nervulus of the posterior wings of the melectines is very oblique, frequently sinuate or curved, and nearly attains the fork of the cubital vein, but is straight and more or less right-angled in the nomadids. In the *Melectinae* the anterior wing sculpture is highly differentiated with a broad band of minute papillae along the anterior margin, whereas the *Nomadidae* have retained a more primitive wing structure, with the papillae and hairs

¹⁾ See also RAYMENT, *Treubia* t.c.p.

more or less evenly distributed. These characters, according to LINSLEY, suggest an anthophoroid origin for the melectine bees, and possibly a panurgoid origin for the nomadids.

In the oriental region only three genera of the *Melectinae* are at present known, viz. *Crocisa* JUR., *Protomelissa* FRIESE, and *Callomelecta* CKLL. Of these tropical genera, *Crocisa* is doubtless the most highly specialized; it has adopted the habitus of the typical parasitic bees, with thickened antennae, strongly contrasting colours and short pubescence, whilst the labial palpi are very short and only two-segmented. This combination of characters does not suggest a derivation from *Anthophora*. The other two genera, however, are much less differentiated morphologically and are thus more recent in origin. Although *Protomelissa* is known to me only from the description, it is probably very closely related to *Callomelecta*. Both genera share many important structural characters with their supposed host genera, *Habropoda* and *Anthophora*; the latter possesses the primitive number of segments in the maxillary palpi, and both present the most *Anthophora*-like appearance. They differ primarily in the strongly modified shape of the mesoscutellum, the oblique nervulus of the posterior wing and those structures, the presence or absence of which are associated with a parasitic mode of life.

The three species of *Callomelecta* now before me are closely related and have the following characters in common:

Moderate to small-sized, compactly built, head and thorax densely pubescent.

Head narrower than thorax, as high as it is wide across the compound eyes, strongly transversely compressed, only one-third as deep (or less) as the width across the eyes, immediately and strongly narrowed behind the eyes, posterior angles not developed. Labrum large, trapezoidal, widest basally, almost twice as broad at base as it is long, and from $\frac{2}{3}$ to $\frac{7}{8}$ as long as the clypeus; lateral margins strongly convex and incurved; basal portion declivous; its entire surface strongly concave when viewed laterally, the apical fourth slightly upcurved; anterior border in dorsal view almost truncate or distinctly emarginate. Clypeus convex, much wider than long, perfectly straight anteriorly, the labro-clypeal suture acute, ridge-like. Mandibles long, stout, strongly curved, crossing at the tips, unidentate or with an angular projection along inner margin, distal portion lanceolate, apices pointed. Malar space linear. Eyes large, bare, widest beneath, attenuated dorsally, extending upwards to slightly below level of lateral ocellus, inner margins of eyes in frontal view feebly converging beneath, the margin itself almost straight. Maxillae when extended with galea + mentum much longer than the head, galea strongly chitinized, pointed, at least twice as long as maxillary palpi. Labial palpi 4-segmented, somewhat shorter than maxilla, first

two joints strong, the two apical joints much slenderer; basal joint very long, 2nd joint about one-third as long as first joint; last two joints very small. Glossa long and cylindrical, its apex slightly swollen and rounded, extending beyond maxillae. Maxillary palpi long and slender, shorter than basal segment of labial palpi, 6-segmented, the joints much longer than wide, 1st joint much shorter than 2nd, 2nd to 5th joints subequal in length, the ultimate (6th) joint slightly shorter than the penultimate. Antennae not modified, cylindrical, moderately short, not attaining tegulae, inserted just posterior to clypeal suture and separated from each other by a distance less than twice as long as that between each of them and the margin of compound eye. Scape arcuate, much longer than wide, pedicel short, wider than long, flagellar joints simple or very slightly nodate, these joints rather longer than wide, last joint about twice as long as wide, its apex flattened and rounded. Flagellum less than four times as long as the scape; average lengths of basal segments (incl. the scape) 77, 13, 25, 33, 27, 29, 27. Ocelli situated in a very slightly curved line on top of the vertex, the median ocellus slightly wider than long, barely in advance of the lateral ones, which are slightly longer than wide; median ocellus separated from each of the lateral ones by a distance equal to the transverse section of lateral ocellus, these separated from margin of compound eye by a distance of about 2.5 times their own diameter. Vertex, dorsum and sides of thorax clothed with very long and dense, erect, feathered pubescence, the hairs concealing the surface entirely.

Thorax large, robust, a little higher than long, entirely covered with long, erect dense pubescence obscuring its surface; pronotum much below level of mesonotum. Mesonotum strongly convex, with distinct though short, slightly raised parapsidal furrows. Mesoscutellum also strongly convex, not or scarcely below level of mesonotum and separated from it by a depressed transverse sulcus; mesoscutellum considerably shorter than mesonotum, with a strong, acute, median longitudinal carina; scutellum arcuate in profile view, steeply sloping posteriorly, each of the upper postero-lateral angles produced into a stout, slightly down-curved, laterally compressed, backwardly directed process, which is a little shorter than and entirely hidden by the pubescence. Postscutellum transverse, vertical, flat, very narrow, its outline narrowly lanceolate. Axilla well-developed, with a strong posterior rim. Propodeum large, the triangular median part hairless, vertical, its surface flat or slightly convex in profile view.

Legs, moderately stout, elongate, pubescent; intermediate and posterior tibiae and femora slightly incrassate, intermediate tibiae of ♀ with a single, slightly curved and flattened, finger-like, extero-apical spine which is much shorter and rather more triangular, in ♂; tibial

spurs long and slender, though distinctly shorter than tibia and also shorter than basitarsus, spurs almost straight, apex not forked or toothed; basitarsus slender, very slightly arcuate, parallel-sided, shorter than tibia, produced into a short, acute, exterior spine on posterior legs of ♀; intermediate and posterior basitarsi approximately two-fifths as long as remaining tarsal segments taken together. Claws bifid, inner rami of claws of intermediate and posterior tarsi short, lobe-like, expanded vertically, truncated; empodium distinct (fig. 3).

Wings broad, lightly infuscated; anterior wing (fig. 1) elongate, surpassing apex of abdomen; three submarginal cells, the first and third subequal in length, the second much smaller, very narrow costally and anally; first recurrent nervure joining second cubital cell at the beginning of its last third; second recurrent nervure entering margin of third cubital cell beyond its middle. Marginal cell elongate-oval, rounded and little attenuated apically, extending rather beyond apex of last (third) submarginal cell. Nervulus (transverse median) of posterior wing long, very oblique, sinuate, nearly attaining fork of cubital vein.

Abdomen comparatively small, when the segments are normally extended shorter than head and thorax together, widest across end of segm. 2, convex, oval in the ♂, rather more inflated on middle with apical segments strongly tapered, almost triangularly pointed, in the ♀. Anterior portion of first tergite vertical, about twice as long as the horizontal part, angles evenly rounded; surface of anterior portion very slightly convex, except on middle basally where it bears a concave impression; first sternite small, projecting on middle; anterior three-fifths of each of the sternites 3-6 (♂) or 3-5 (♀) feebly transversely convex, followed by a weak transverse impression most distinct on each side of the middle; apical margin of these sternites almost straight or very slightly concave. Sixth tergite of ♀ with a well-defined pygidial field; 6th sternite strongly narrowed apicad, gutter-shaped, margins raised, projecting beyond apex of 6th tergite. Seventh tergite of ♂ without a pygidial field, subtriangular in outline, apex excised; 6th sternite of simple structure; 7th and 8th sternal plates well-developed, though very small. Genital apparatus (phallic organ) small. Dorsal plate at base of penis very large, membranous, covering part of the sagittae. Sagittae shorter than parameres (valvae externae), of complex structure, distal portion of each with several tooth-like protuberances and apically produced into a long, finely pointed, downwardly projecting spur, which is best visible in profile view and when looked at from behind. Volsellae present, but small, visible in ventral aspect of phallus as small hairy basal lobes, situated between parameres and sagittae. Parameres rather short, each with a still shorter interior branch, the outer branch finger-like, projecting backward far beyond sagittae, their inner and outer surfaces

clothed with long bristles; inner branches closely approximated to the outer ones, visible from above mainly as incurved vertical plates, their upper margin (especially at base) carrying strong bristles, their inner surface clothed with a dense brush-like bunch of recurved hairs.

The species of this genus are probably mainly parasitic on *Habropoda*. The host of *pendleburyi* is not known, but *C. habropodae*, according to COCKERELL, greatly resembles *H. sutepensis* CKLL, with which it occurred together on the summit of Mt. Doi Sutep, in Siam; further, our new species *C. vulpecula* was flying with many *H. impatiens* in one locality in South Sumatra, whilst *C. insidiosa* was captured on the same day, on visiting the same kind of flower, as *H. erratica*, at Telagawarna, West Java.

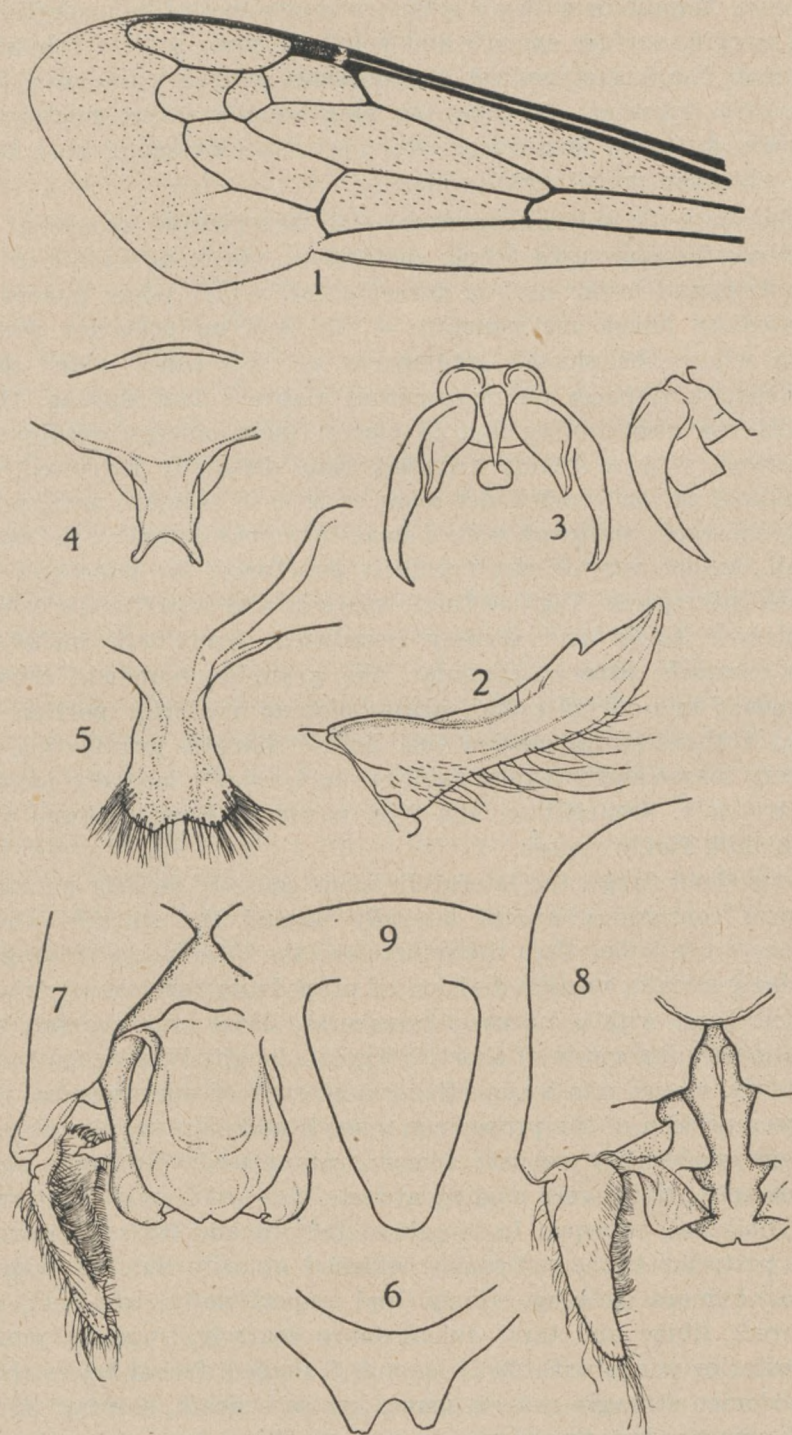
Nothing, however, is known with regard to the lifehistory of all these species.

***Callomelecta pendleburyi* COCKERELL (fig. 1-9).**

1926, COCKERELL, Ann. Mag. Nat. Hist. (9) 18, p. 621-622.— ♀ Selangor.

Material studied. — Malay Peninsula: 1 ♀ (allotype), Perak, Fed. Mal. States, Larut Hills, 4500-4700 ft., ii. 1932, H. M. PENDLEBURY; 1 ♀, Pahang, Fed. Mal. States, Cameron's Highlands, 5000 ft., 13. vi. 1935, H. M. PENDLEBURY.

♀. Structure. — Labrum in dorsal view more than twice as wide along base as it is along distal margin, and slightly less than twice as wide along base as its length over the middle (62:37); lateral margins turned down, apical margin flat, very slightly emarginate, the angles rounded; distal one-third with a faint indication of median carina. Clypeus twice as wide as labrum, with a feebly developed, short median carina just in front of the antennae, which, however, is continued upwards on frons and vertex so as to form a definite, acute carina between the antennae. Entire surface of labrum and clypeus coarsely and rather densely but not deeply punctured; puncturation on disk of labrum moderately dense, irregular, the punctures mostly separated by their own width but apically smaller than the interspaces, which themselves are slightly shiny; apical margin, the folded lateral margins (including a smooth rounded baso-lateral tubercle), and a small area on each side of the median carina, impunctate, rather shiny. Clypeus closely and evenly punctured, except along anterior margin, punctures mostly separated by their own width; interspaces and area around basal carina dull, finely rugose. Frons and vertex in front of ocellar region densely irregularly punctate, the interspaces smooth and shining; surface of ocellar region microscopically wrinkled with a few scattered small



Callomelecta pendleburyi Ckll. ♂ (fig. 3. ♀ posterior tars. Malaya)

punctures. Mandibles with an obtuse-angulate tooth-like projection along inner margin, surface smooth and polished, bases with a few scattered punctures. Scape and pedicel of antennae coarsely punctate; flagellar joints dull, together 3.5 times as long as the scape, microscopically reticulate, distinctly longer than wide, second joint longer than first and third, which are about equally long.

Thorax with the mesoscutum and mesopleurae coarsely, densely punctured, the punctures nearly contiguous, except at middle of disk of mesonotum and lower half of mesopleurae, where some punctures are separated by about one puncture width, and on posterior portion of scutum where the smooth interspaces are 2-3 times wider than the punctures; interspaces on mesoscutum glabrous and shining, those on mesepisterna also shining, but in places finely, microscopically striate; mesoscutum with a weakly elevated, fine, distinctly furrowed, median longitudinal carina which fades away at level of tegulae; parapsidae also slightly elevated, furrowed, with a small impunctate area on the outer side of each. Axillae very finely, regularly punctured, the punctures smaller than the interspaces. Tegulae finely sparsely and superficially punctured. Metapleurae finely and densely punctured. Scutellum, including the spines, coarsely densely granular, the granules roundish, convex, all contiguous; mid-dorsal carina acute; sloping posterior portion with a distinct transverse impression just before margin, granulation of this part very coarse and irregular; spines short, robust, laterally compressed, apex truncate, emarginate, the tips rounded. Postscutellum with its surface dull, finely rugose.

Propodeum large, the lateral divisions coarsely densely punctate, the punctures contiguous, except laterally beyond the spiracle where the interspaces are wider than the punctures; the interspaces shining, finely irregularly striate; median division of propodeum (enclosure) triangular, broad at base, with a narrow, transverse, basal area coarsely rugose-punctate, forming a row of short, irregular, longitudinal carinulae which, posteriorly, merge into a superficial meshwork of microscopical reticula, the lower portion of the propodeum smooth and shining, almost polished.

Legs moderately robust; femora compressed, distinctly narrowed towards apex; tibiae very slightly arcuate, those of first and intermediate legs cylindrical, subequal in length to femora and little narrower than these; posterior tibiae noticeably widened apically but not wider than femora. Femora shining, finely and superficially, and not densely punctured; tibiae and tarsi duller, more coarsely, rugosely punctured.

Posterior wings with 20-21 strong, S-shaped, frenal hooks (hamuli).

Abdomen strongly convex above, less so beneath, shining, appearing almost smooth, but the segments are evenly, very finely, though not closely, punctated above and beneath, the interspaces wide and glabrous;

sides of 3rd to 5th tergites, each about half-way their length, very feebly transversely swollen, behind this very slightly depressed; 1st to 4th tergites without differently sculptured or coloured apical marginal areas; posterior margin of 3rd and 4th tergite not punctate but microscopically reticulate, the reticulate area very narrow on 3rd, wider on 4th tergite (occupying about one-fourth of its length); 5th tergite more coarsely and closely punctured than preceding segments, the punctures hardly smaller than the interspaces, the (unexposed) basal part of 5th tergite more finely and less densely punctured, the interspaces throughout finely reticulate; surface of the narrowed apical part of 5th tergite rather shining, basally with only few scattered punctures, distally not punctate but covered instead with a microscopically fine network of transverse reticula; apical margin of 5th tergite narrow, but well-developed, depressed, rather shining, its surface microscopically reticulate. Sixth tergite densely coarsely punctured; pygidial area very distinct, broadly triangular, one and one-half times as long as its basal width, not attaining base of tergite; surface of median triangular area feebly convex, between this and lateral margins slightly concave, the side-margins strong, acute, a little upcurved; apex of pygidial plate slightly produced, flat, broadly and obtusely rounded; entire surface of pygidial plate dull, very closely microscopically scaled, the scales roundish, smooth. Sternites finely, moderately densely punctated, the apical margins broad, their surface smooth, with a few scattered fine punctures, or impunctate. Sixth sternite narrow, gutter-shaped, tapered apicad, projecting much beyond apex of pygidial plate of 6th tergite; lateral portions directed straight upwards, their upper margins broadly membranous, hyaline; apex in ventral view with a median longitudinal furrow; ventral surface of 6th sternite microscopically scaled, the apex punctated.

Colour. — Head and thorax brownish-black. Labro-clypeal suture chestnut-coloured, the basal tubercles of labrum ferruginous. Mouth-parts dark ferruginous, the galeae black on middle. Mandible-bases shining black, then chestnut-coloured, apices darker brown. Scape of antennae dark reddish-brown anteriorly, with a minute ferruginous spot in front at extreme base, posteriorly almost black; flagellar joints blackish-brown on their posterior face, dark reddish-brown anteriorly. Tegulae pale ferruginous. Posterior rim of axillae brown.

Legs dark brown with a definite reddish tinge; tibial spurs chestnut-coloured, the tibial processes as well as the apical tarsal joints rather more ferruginous; tips of claws black.

Wing-venation brown, the costal nervures blackish-brown; membrane dilute ferruginous with diffuse smoky-grey patches in the anterior portion and apical margin of fore wing; costal part of marginal cell more definitely obscured.

Abdomen brownish-black, almost black, apical margins of 1st to 4th tergites very narrowly brown, the lateral tergal margins, and the apical margins of 1st of 5th sternites coloured more broadly brownish-yellow or ochraceous, and translucent in certain lights; apical margin of 5th tergite still more broadly and also distinctly pale-coloured, translucent; 6th tergite brown, the pygidial plate dark brown, with its lateral margins deep black; 6th sternite russet, the apex ochraceous-tawny.

P u b e s c e n c e. — Labrum face moderately densely clothed with short, sub-appressed, greyish-yellow (pale olive-buff) hairs and with rather longer, thinly scattered, sub-erect light ochraceous hairs between, the pubescence not concealing surface; clypeus more densely clothed with appressed pale hairs; margin of labrum and lower margin of mandibles basally fringed with still longer scattered hairs. Cheeks and side of face along inner orbits with a narrow tuft of erect ochraceous hairs. Frons and vertex, from level of antennal sockets upwards to slightly before ocelli, densely clothed with tufts of long, feathered, orange buff hair concealing most of the surface; vertex on top with sparse, sub-appressed fulvochraceous pubescence, the surface well visible; head beneath and behind the eyes moderately densely clothed with long, light ochraceous buff pubescence. Antennae with the scape and pedicel anteriorly with rather long, sparse, sub-erect, light ochraceous hairs; flagellar joints almost nude, pubescence microscopical, appressed.

Thorax entirely and very densely clothed with long, erect, strongly plumose orange (capucine yellow) hair, longest on mesoscutellum, the pubescence very bright (mikado orange) postero-dorsally, slightly paler (orange buff) laterally and beneath, wholly obscuring the surface except on meso- and metapleurae, where the puncturation remains visible; similar dense pubescence on mesoscutellum also obscuring the spines, which are about half as long as the hairs. Propodeum equally densely pubescent except the large, triangular enclosure about which the hairs are scattered and sparse, not hiding the surface, the median part of the enclosure being entirely hairless.

Legs sparsely clothed with rather short, ochraceous, sub-recumbent pubescence, hairs on femora short and sparse, anterior and intermediate femora with a posterior fringe of much longer hairs; pubescence of tibiae and tarsi appressed, somewhat longer and denser than on femora but not nearly concealing surface, except on intermediate and posterior basi-tarsi, which are more densely pubescent and whose inner faces bear an elongate, dense, brush-like patch of very short, golden-brown hairs hiding the surface.

Abdomen sparsely pubescent. Vertical surface of 1st tergite with short, sparse, appressed ochraceous hairs, the pubescence on dorsal portion of this segment slightly longer, more dense, distinctly plumose,

sub-appressed, concealing surface only in certain lights, light ochraceous buff, but darker along posterior margin, where the hairs are shorter, shading to cinnamon-brown; pubescence beneath short, appressed, blackish-brown; hairs on following tergites moderately dense, very short, appressed, not concealing surface, brownish-black in colour; each of the tergites 2, 3 and 4 moreover with a narrow, transverse, lateral patch of light ochraceous buff pubescence, these fasciae situated just behind the transverse convexities of each segment and formed of appressed plumose hairs; in dorsal view the fasciae on 2nd and 3rd tergite are separated from one another by a distance longer than their own width, those on 4th tergite being very small; 4th tergite along transverse depression in addition with a sparse fringe of long, sub-erect, arcuate, dark brown hairs, which are longest and most numerous on each side of the tergite; surface of distal portion of 5th tergite similarly, though more densely, fringed with long arcuate hairs, the hairs increasing in length posteriorly. Exposed surface of 6th tergite, on each side of the pygidial area, densely clothed with pale brownish appressed hairs, increasing in length towards apex. Distal portion of gutter-shaped 6th sternite sparsely pubescent beneath, apex with a dense fringe of bristle-like yellow hairs.

♂. Structurally differs from the ♀ only in the following characteristics.

Labrum slightly less broad than in the opposite sex, its greatest width slightly in advance of the base, distinctly less than twice as wide as its length over the middle (54:35); apical angles evenly rounded, the free margin almost straight in dorsal view. Tooth along inner margin of mandibles better developed, though small and rounded (fig. 2). Antennae a little shorter, not nearly reaching tegulae; all flagellar joints, and especially the 5th to 13th segments of antennae, comparatively shorter, not modified, ultimate joint one and one-half times longer than penultimate. Surface of tibiae of posterior legs more conspicuously rugose than in ♀, coarsely tuberculate-punctate.

Second cubital cell of anterior wing still narrower than in the female.

Abdomen oval (apical segments contracted), less convex dorsally, the transverse swellings on each side of the middle of 3rd to 5th tergites even less developed than in the ♀. Posterior portions of abdominal tergites superficially microscopically reticulate between the punctures (more distinctly so than in ♀), otherwise similar. Seventh tergite densely coarsely punctured, broadly triangular, apex with a short, V-shaped median fovea and produced into two short lobes, which are separated by a V-shaped incision (fig. 6). Sixth sternite simple: apical margin evenly rounded. Outer spatha (seventh sternal plate), and inner spatha (eighth sternal plate) as in fig. 5 and 4. Genitalia shaped as shown in fig. 7-8.

Body-colouring and pubescence very similar to the ♀. The dense appressed pubescence on clypeus less grey, pale cream-coloured and shining in certain lights.

Pubescence on abdomen generally darker than in ♀, uniform brownish-black, basal two-thirds of 1st tergite moreover intermingled with sparse, sub-erect, ochraceous-tawny hairs, which are conspicuous only in certain lights; tergites 2-4 without lateral patches of appressed pale pubescence but the transverse convexities and the latero-ventral angles of 2nd to 6th tergites are sparsely fringed with dark brown hair, similar to the ♀. Seventh tergite densely clothed with short, appressed tawny hair, marginal hairs somewhat longer but scarcely longer than the apical protuberances.

♀ Length 13.0, anterior wing 9.0 mm; ♂ length 12.3 mm, anterior wing 8 mm.

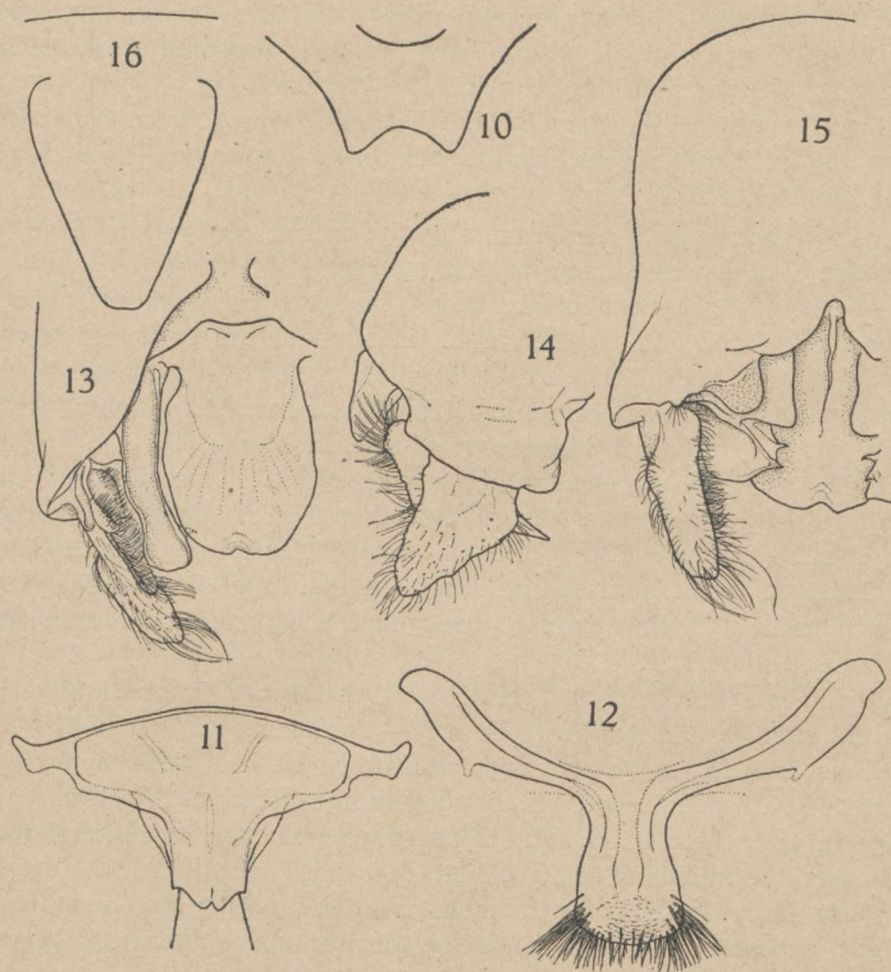
Mr. PENDLEBURY, who discovered this species in Selangor, informs me in a letter dated Oct. 1st, 1940, that *C. pendleburyi* was never found by him in damp localities with which the wild yellow Balsam (*Impatiens oncidoides*) is associated. The type was found „flying along a laterite bank, examining all the holes and crevices”.

Both species resemble *Crocisa* in the stealthy way in which they pursue their task and the Malayan species, according to PENDLEBURY, produces a characteristic shrill note when on the wing.

***Callomelecta vulpecula*, sp. n. (pl. 42 fig. 1, 2, text fig. 10-16).**

Material studied. — Sumatra: 4 ♂, 2 ♀, South Sumatra, Lampoeng residency, Giesting, foot of Mt. Tanggamoos, 600 m, ult. xii. 1939 (2 ♂), and 21 & 27-29.iii.1940 (2 ♂, 2 ♀), Mrs. M. & M. A. LIEFTINCK, on flowers of *Polygala venenosa* (1 ♂, xii. 1939), and of *Impatiens* cf. *oncidoides* (2 ♂, 1 ♀, iii. 1940 and 1 ♂, xii. 1939), and under shady bank along forest-path (1 ♀, 29.iii.1940). 1 ♂, Central Sumatra, Westcoast residency, Fort de Kock, 920 m, viii.1918, EDW. JACOBSON (in coll. J. VAN DER VECHT). Holotype ♂: Mt. Tanggamoos, 21.iii.1940, allotype ♀: id., 29.iii.1940, Mrs. M. & M. A. LIEFTINCK.

♀. **Structure.** — Labrum in dorsal view not carinate apically, about twice as wide along base as it is along distal margin and as its length over the middle (47:25); lateral margins turned down, apical margin flat, distinctly though shallowly emarginate, the angles obtuse-angulate and rounded. Clypeus less than twice as wide as labrum. Antennae with the flagellar joints very little shorter than in *pendleburyi*, but the ratios are approximately equal. Sculpture of head, thorax and legs otherwise practically identical to the preceding species, but the transverse

*Callomelecta vulpecula* sp. n. Sumatra.

basal area of propodeum more superficially rugose and the microscopical reticula on the posterior part of the enclosure also finer.

Wings as in *pendleburyi*; posterior wings with 19-20 frenal hooks.

Abdomen very similar to *pendleburyi*, the tergites less densely punctated and reticulate areas of 3rd and 4th tergites more extensive, occupying almost the whole surface, the exposed parts of 5th and 6th tergites as in the preceding species. Sixth tergite with conspicuous pygidial plate (fig. 16), shaped almost similarly to *pendleburyi*, but its surface decidedly more shining, as the dense microscopical scaling, however distinct, is more superficial, less impressed, than in *pendleburyi*. Sixth sternite not different in shape from the preceding species.

Colour black. Head with the mouth-parts and sutures marked with brown, chestnut-colour and ferruginous as described for *pendleburyi*.

Scape of antennae black; sockets with a diffuse ferruginous spot anteriorly; flagellar joints pitchy black on their posterior face, tawny anteriorly. Tegulae xanthine-orange.

Legs as far as the apex of the basitarsi, deep black; remaining tarsal joints orange-rufous, claws dark brown apically. Tibial spurs brownish-black, almost black.

Wing-venation and membrane slightly darker, less yellow, than in *pendleburyi*, otherwise similar to that species.

Abdomen throughout black, tergal margins very narrowly dark brown, except the fifth tergite, which is more definitely amber-brown distally, and the edges of the sternites, which are distinctly though finely seamed with ochraceous-orange and translucent in certain lights. Sixth tergite similarly coloured, but the pygidial plate black.

Pubescence on head, thorax and legs as in *pendleburyi*, the sub-appressed pubescence on labrum, clypeus and on frons between antennae glistening silvery-white with slight yellowish intermingling, the long erect hairs on top of head and on dorsum and sides of thorax still more conspicuous than in that species, throughout bright xanthine-orange on dorsum, paler laterally.

Abdomen sparsely clothed with brownish-black pubescence, slightly different from *pendleburyi*, as follows: — the horizontal part of the 1st tergite is not, as in *pendleburyi*, uniformly clothed with appressed ochraceous-buff pubescence, but besides being rather more ochraceous-orange in tint, these hairs form a narrow, transverse, sub-interrupted fascia over the middle of the segment, the apical margin of 1st tergite being also narrowly fringed with short pale hairs on middle. The patches of light pubescence on the following tergites are obliterated, barely visible from above, restricted to a triangular postero-lateral greyish-yellow fleck on each side of 3rd tergite, but quite unapparent on the 4th segment. Pubescence of sternites paler than in *pendleburyi*, on 6th tergite more dense, and of a conspicuous silvery-yellow tint; pygidial area hairless.

♂. Generally differs from the ♀ in the same way as *pendleburyi*. Labrum approximately as in the ♀. Tooth along inner margin of mandibles well pronounced, shaped similarly to the ♂ of *pendleburyi*; antennae and legs also similar to that species.

Abdomen in natural position shaped as shown in the photograph, not differing structurally from *pendleburyi*. Seventh tergite densely coarsely punctured, broadly triangular, apex with a short, V-shaped median fovea and produced into two bluntly triangular projections, the excavation less deep and distinctly wider than in *pendleburyi* (fig. 10). Sixth sternite slightly projecting, its margin evenly rounded. Seventh

and eighth sternites shaped as shown in fig. 12 and 11, respectively. Genitalia see fig. 13-15.

Body-colouring and pubescence very similar to the ♀. Pubescence on abdomen unicolorous brownish-black except on the basal half of the 1st tergite where the dark appressed pubescence is intermingled with sparse but much longer light brown hairs, which are conspicuous only in certain lights at the sides of the tergite; hair on tergites of following segments, including the seventh, similar to the ♂ of *pendleburyi*. Posterior margins of abdominal sternites fringed with short silvery yellow pubescence most conspicuous on the sides of sternites 3 to 5.

♂. Length 13.5, anterior wing 8.6 mm (holotype), 12.0-12.8, 8.5-8.7 (paratypes); ♀ length 12.7, anterior wing 9.2 mm (allotype), 11.6, 8.8 mm (parallotype).

The ♂ from Fort de Cock is somewhat smaller in size, measuring 11.5 for the body, 8.6 mm for the anterior wing. The pubescence of the head and thorax is discoloured, but an examination of the internal sternal plates and phallic organ of this specimen proves its identity with *vulpecula*.

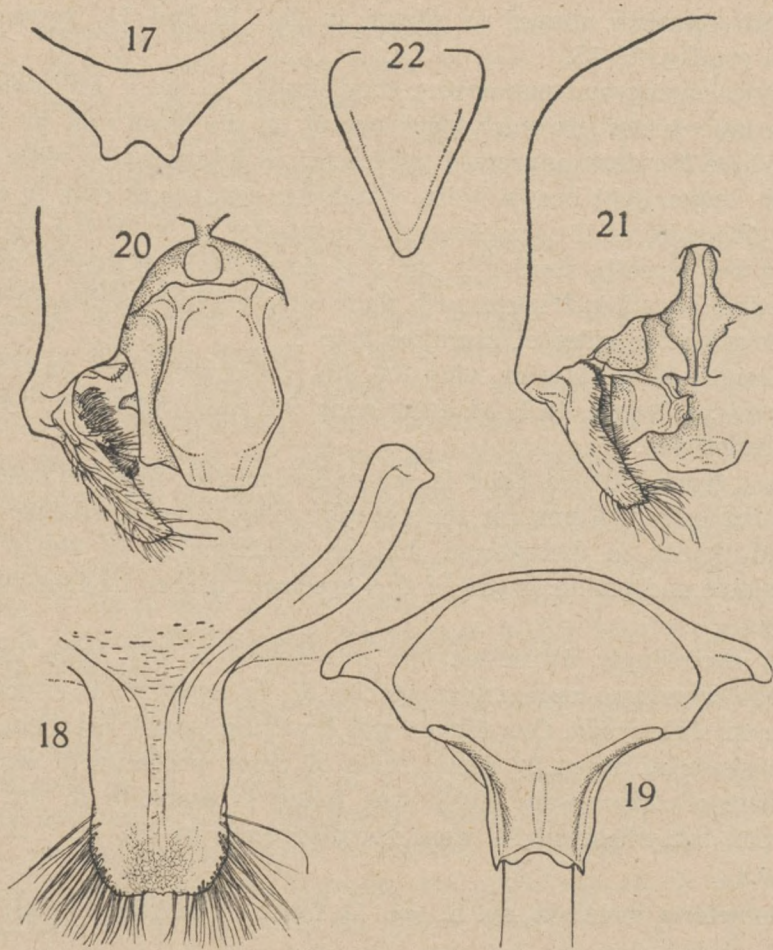
This exceedingly attractive bee was found in the same place as *Habropoda impatiens* and various species of *Anthophora*; it is doubtless parasitic on *Habropoda*. One female was hovering among a vertical bank in dense shade afforded by aerial roots of trees, probably in search of the nest-site of *Habropoda*, which was found in numbers in the forest not far off, but whose shafts were not discovered by us.

***Callomelecta insidiosa*, sp. n. (pl. 42 fig. 3-4; textfig. 17-22).**

Material studied. — Java: 1 ♂, 2 ♀, West Java, Buitenzorg residency Telagawarna (Poentjak pass), 1450 m, 4.vi (1 ♂, 1 ♀) and 18.vi.1939 (1 ♀), on flowers of *Impatiens chonoceras*, M. A. LIEFTINCK; 1 ♂, West Java, Buitenzorg res., Mt. Pangerango, estate Tjisaroea Zuid, 1100 m, 12.ii.1939, Mrs. M. LIEFTINCK, in flower of *Impatiens platypetala*; 1 ♂, West Java, Buitenzorg res., Mt. Gedeh, Tjibodas, 1450 m, 20.iv.1940, J. VAN DER VECHT; 3 ♂, West Java, Buitenzorg res., Soekanegara, 400-800 m, ii.1940, native collector. Holotype ♂ and allotype ♀: Telagawarna, 4.vi.1939, M. A. LIEFTINCK.

Resembles *C. vulpecula* and *pendleburyi* in general appearance, but is of small size and has the abdominal tergites with complete bands of appressed pubescence.

♀. **Structure.** — Very similar to the preceding species. Labrum in dorsal view less narrowed apically and with the side-margins more convex than in *vulpecula*, less than twice as wide along base as it is



Callomelecta insidiosa sp. n. W. Java.

along distal margin, and slightly less than twice as wide along base as its length over the middle (43:26), the apical margin more distinctly emarginate than in *vulpecula* (about as much as in *pendleburyi*), the angles rounded; no indication of median carina. Clypeus slightly less than twice as wide as labrum. Median carina on top of head strongly developed, extending upwards from just behind fronto-clypeal suture, at level of the antennal sockets, to somewhat before median ocellus. Punctuation of face and frons very similar to the preceding species; surface of ocellar region smooth and shining, sparsely punctate, near the eye-margin microscopically wrinkled. Mandibles shaped and sculptured as in *vulpecula*, the projection along inner margin tooth-like, obtuse-angulate. Scape and pedicel of antennae more superficially and less coarsely punctate than in the preceding species; flagellar joints together

about 3.8 times as long as the scape, their shape not different from the other species.

Thorax even a little more arched dorsally, with the pubescence anteriorly still longer, than in *pendleburyi* and *vulpecula*. Sculpture and puncturation of thorax quite similar to these species, but the sloping posterior portion of the scutellum not definitely impressed; spines longer, robust, more definitely downcurved, laterally somewhat compressed, each parallel-sided in lateral view, apex straight cut off but with the angles rounded. Sculpture of propodeum as described for *pendleburyi*, the enclosure shining but not polished, its surface very finely, microscopically wrinkled.

Legs as in the preceding species.

Posterior wing with 19 strong, S-shaped, frenal hooks.

Abdomen shaped as in the other species, shining, all segments evenly, finely, superficially, not very closely punctated above and beneath, dorsal surface of basal half of sides of 1st tergite glabrous, almost polished, of all remaining segments microscopically reticulate between the punctures, which are more sparsely distributed towards the apical margins; these instead more closely transversely reticulate, the reticulate areas increasingly wider posteriorly, occupying at least the basal half of the exposed portion of 4th and the entire 5th tergite, where the reticula form a fine network. Sixth tergite densely finely punctured, the interspaces finely reticulate; pygidial area very distinct, shaped much as in *vulpecula* but more attenuated distally, about one and one-third as long as its basal width, not attaining base of tergite, apex narrowly rounded; entire surface dull, basal half distinctly though somewhat irregularly punctated, the interspaces coarsely reticulate, distal part microscopically scaled, the scales oval, smooth, placed in the long axis of the plate (fig. 22).

Puncturation of sternites and shape of 6th sternite as described for *pendleburyi*, 6th sternite more strongly tapered apicad, the tip narrowly rounded off.

Colour. — Head and thorax blackish-brown, mouth-parts and marginal ridges marked with russet or chestnut colour as in the preceding species, distal margin of labrum usually also with a diffuse pale streak or fleck. Antennae brownish-black, the outer flagellar joints uniform chestnut-brown or mummy-brown. Tegulae mars yellow.

Legs, as far as the apex of basitarsi, blackish-brown (mars brown); remaining tarsal joints orange-rufous to Sanford's brown, claws black apically. Tibial spurs dark brown.

Wing-venation dark brown, the costal nervures darkest; membrane dilute ochraceous-buff with very diffuse patches of smoky-grey in the antero-apical portion of both pairs of wings; marginal cell only little more obscured than the rest of wing.

Abdomen dark mummy brown to almost black, the latero-ventral margins of the tergites narrowly ochraceous-tawny; apical margins of the sternites more broadly pale-coloured, those of 3rd to 5th segments narrowly seamed with dull yellow-ochre in certain lights; 6th tergite ochraceous-tawny to cinnamon-brown, the pygidial plate mummy brown; 6th sternite russet, the apex hazel-coloured.

P u b e s c e n c e of head, thorax and legs very similar to *vulpecula*, but the plumose hair still longer, more floccose and less bright than in that species. Sub-appressed and intermixed erect pubescence on face ochraceous-buff; long, tufted, heavily plumose hairs on frons and vertex ochraceous-orange, hairs on cheeks paler; flocky pubescence on thorax very long, bright ochraceous- to zinc-orange, only slightly paler laterally and beneath.

Legs with the tibiae more densely pubescent, and the hairs slightly longer, than in the two preceding species, colour ochraceous-buff, the apical tufts of tarsal joints and brush-like hairs on the inner faces of the basitarsi, zinc-orange.

Pubescence of abdomen strikingly different from the two preceding species. Entire surface of abdominal tergites evenly but sparsely clothed with short, sub-appressed, non-plumose, tawny (ochraceous-tawny in certain lights) hairs, which do not conceal the dullishly shining surface, this pubescence most dense along posterior margin of each segment; tergites 1-5 moreover with a sparse fringe of much longer, erect, arcuate hairs of the same colour along the transverse swellings behind the middle of each segment, these hairs longest on the side of 1st tergite; tergites 1-5 moreover with rather distinct, but narrow, fasciae of dense, plumose, depressed ochraceous-orange pubescence, concealing most of the surface, these bands variable in width, usually narrow on tergite 1 and 2, successively wider and more removed apicad on following segments; basal declivity of 1st tergite with short and sparse depressed pubescence; 6th tergite on each side of the pygidial plate more densely clothed with long, appressed, shining ochraceous-buff, plumose pubescence; base of pygidial plate with very short, scattered, light buff hairs. Basal half of abdominal sternites sparsely clothed with short, sub-appressed, russet pubescence sparsely intermixed with longer sub-erect hairs; apical hair-fringes stronger, more dense, and pale-coloured (ochraceous-tawny); 6th sternite with an apical tuft of short golden-yellow bristles.

♂. Closely resembling the ♀ in general appearance and differing only in the shape of its abdomen, and in the following particulars.

Labrum distinctly shorter and wider, almost twice as wide as its length over the middle (43:23), its width along anterior margin only little less than along base; apical angles broadly rounded, the excision less wide. Tooth along inner margin of mandibles shaped approximately

as in the same sex of *pendleburyi*. Antennae slightly thicker and shorter, not reaching tegulae, differing from ♀ in the same way as described for *pendleburyi*. Tibiae slightly more swollen apicad than in the opposite sex.

Puncturation and pubescence of abdomen similar to the ♀. Seventh tergite densely clothed with short appressed, golden-yellow pubescence, marginal bristles not or scarcely exceeding length of apical prominences; its surface densely coarsely punctured, shaped much as in the preceding species, the apical projections shaped as shown in fig. 17. Sixth sternite simple, with the apical margin evenly rounded. Seventh and eighth sternites shaped as shown in fig. 18 and 19, respectively. Phallus see fig. 20-21.

♂. Length 11.5, anterior wing 8.5 mm (holotype), 11.0-12.0, 8.4-8.8 mm (paratypes); ♀ length 10.4, anterior wing 7.8 mm (allotype), 10.6, 8.2 mm (parallotype).

This handsome little species looks very different from both *pendleburyi* and *vulpecula*. It is perhaps worth mentioning that, in its genital organs (more especially in the shape of the tiny apical abdominal sternites), the ♂ *insidiosa* agrees more closely with *pendleburyi* than the latter resembles *vulpecula*.

Probably a very scarce species and only to be found under favourable circumstances. At Telagawarna it was captured on the same day and visiting the same kind of flower as *Habropoda erratica*, on which it is probably parasitic.

Key to the known species of *Callomelecta* ¹⁾

Females

1. Pubescence on dorsum of abdominal segments short and sparse, mainly dark, not concealing surface, strongly contrasting in colour with long feathery pubescence on head and thorax. Malay States, Sumatra 2
- 1'. Pubescence on dorsum of abdominal segments short but dense, mainly light brown, forming distinct transverse bands of appressed plumose hairs partially concealing surface in certain lights, but not strongly contrasting in colour with long feathery pubescence on head and thorax. Labrum emarginate anteriorly. Pygidial plate of 6th abdominal tergite strongly tapered apically, its surface punctate basally, microscopically scaled distally. Java *insidiosa*
2. Anterior margin of labrum almost straight or very slightly concave. Tegument of body and legs reddish- to brownish-black. Dense erect

¹⁾ I have not seen *Callomelecta habropodae* CKLJ., known only from a single ♂ (Siam). It differs from the other species in the colour of the abdomen, which is described as „shining bright clear ferruginous,” also in the dusky red legs and in the abdomen having “short appressed pale fulvous tomentum on apices of second and following segments,” (*Ann. Mag. Nat. Hist.* (10), 4, 1929, p. 133).

feathery pubescence on dorsum of thorax capucine-yellow to mikado-orange. First abdominal tergite mainly clothed with short, sparse, light ochraceous-buff pubescence, following tergites with very short, brownish-black hairs, 2nd to 4th moreover with transverse lateral patches of appressed light ochraceous-buff pubescence. Pygidial plate of 6th tergite dull, distinctly microscopically scaled, not punctate. Malay States **pendleburyi**

- 2'. Anterior margin of labrum distinctly emarginate. Tegument of body and legs black. Dense erect feathery pubescence on dorsum of thorax bright xanthine-orange. First abdominal tergite clothed with short, appressed, ochraceous-orange hairs which form a narrow, transverse and obliterated fascia, following tergites sparsely clothed with almost unicolorous brownish-black pubescence. Pygidial plate of 6th tergite more shining, its surface not punctate, the dense microscopical scaling more superficial than in preceding species. Sumatra **vulpecula**

Males

1. Pubescence on dorsum of abdomen short but dense, mainly light not concealing surface, strongly contrasting in colour with long feathery pubescence on head and thorax. Malay States, Sumatra ... 2
- 1'. Pubescence on dorsum of abdomen short but dense, mainly light brown, forming distinct transverse bands of appressed plumose hairs partially concealing surface in certain lights, but not strongly contrasting in colour with long feathery pubescence on head and thorax. Labrum emarginate anteriorly. Apical lobe of 7th abdominal sternite lingulate, not constricted basally, the sides parallel, apex subtruncate, surface of distal portion microscopically longitudinally reticulate and fringed on either side with a fan-shaped bunch of long and strong marginal setae. Apical lobe of 8th abdominal sternite subquadrate, with extero-lateral angles turned down, acute-angulate, projecting slightly beyond level of the median lobe, which is not produced but shallowly and broadly emarginate, forming two widely separated prominences; from the inner edge of the extero-lateral angles rises one strong seta on each side. Apex of 7th abdominal tergite produced into two small, more or less ear-shaped lobes, separated from each other by a wide emargination, which is about equal in size to each of the projecting lobes. Genitalia see fig. 20-21. Java **insidiosa**
2. Anterior margin of labrum almost straight or very slightly concave. Tegument of body and legs reddish- to brownish-black. Dense erect feathery pubescence on dorsum of thorax capucine-yellow to mikado-orange. Apical lobe of 7th abdominal sternite strongly constricted

basally, more or less triangular in outline, apex shallowly emarginate, its surface finely wrinkled and fringed apically with a fan-shaped bunch of strong marginal setae. Apical lobe of 8th abdominal sternite narrow, parallel-sided, the tip divaricate with a deep U-shaped emargination and produced on either side into a finger-shaped process, which, in side view, is again slightly notched apically; marginal setae absent. Apex of 7th abdominal tergite produced into two more or less triangular lobes, which are irregularly truncated apically and separated from each other by a deep U-shaped excision which is about equal in size to each of the projecting lobes. Genitalia see fig. 7-8. Malay States **pendleburyi**

- 2'. Anterior margin of labrum distinctly emarginate. Tegument of body and legs black. Dense erect feathery pubescence on dorsum of thorax bright xanthine-orange. Apical lobe of 7th abdominal sternite constricted basally, apex evenly rounded, surface of distal portion finely transversely wrinkled and fringed apically with a fan-shaped bunch of strong marginal setae. Apical lobe of 8th abdominal sternite with rectangulate side-edges, the tip produced and narrowly excised, forming two small and rounded projecting lobes; from the inner edge of the lateral angles rises one strong seta on each side. Apex of 7th abdominal tergite produced into two more or less triangular protuberances, separated from each other by a shallow emargination, which is much wider than each of the projecting lobes. Genitalia see fig. 13-15. Sumatra **vulpecula**

Subfam. ANTHOPHORINAE.

Genus *Habropoda* SMITH.

1854. SMITH, Cat. Hym. Coll. Brit. Mus. 2, p. 313 (*Habrophora*)-320 (nom. nov.), T. 7 fig.7.

1869. DOURS, Monogr. icon. *Anthopora*, p. 30 n. 1 (♂♀), T. 2 fig. 1 (♀), (♂) (genotype discussed).

1896. DOLLA TORRE Cat. Hym. 10, *Apidae*, p. 252

1897. BINGHAM, Fauna Brit. India. Hym. I, p. 414 (key), 521-522,

1899. ASHMEAD, Trans. Amer. Ent. Soc. 26, p. 60 (key),

1914. MEADE-WALDO, Ann. Mag. Nat. Hist. (8) 13, p. 45-46 (key).

The chief character that has been used by previous authors as a means of distinction between the two genera *Anthophora* and *Habropoda*, is found in the venation of the anterior wing. In *Habropoda* the first recurrent nervure is received at the apex of the second cubital cell, hence is interstitial with the second transverse cubital nervure, the second cubital cell being more or less quadrate; in *Anthophora*, however, this nervure is received by the second cubital cell at or a little beyond or before its middle, and the second cubital cell is more or less narrowed anteriorly, sometimes almost pentagonal. The structure of the mouth-parts

is apparently the same in the two genera: BINGHAM's statement of the basal segment of the 4-jointed labial palpi of *Habropoda* being equal in length to the second segment, is obviously incorrect as is clearly shown by his drawing of the labium of an Indian species of *Habropoda*, in which the first segment of the labial palpi, like *Anthophora*, is much longer than the second. The proportionate length of the segments of the maxillary palpi is apparently also very much alike in the two genera, the second joint being much longer than the first and approximately half as long as the four apical joints taken together. In BINGHAM's generic diagnosis of *Habropoda*, the author expressly states that he has described the characters as found in the Indian species. In this description the ♀ of *Habropoda* is said to have the posterior tibiae with their apex above produced on the inside of the basal joint of tarsi, a character that does not apply to either of our Malaysian species, described in the present paper; on the other hand, the ♂ of our Sumatra species agrees with the Indian members of the genus in that posterior femora are more or less swollen and the tibiae flattened with their apex beneath produced. The anterior wing, according to BINGHAM, has the apex of the radial cell acute in females, rounded in the males; in both sexes of all Malaysian examples examined by me, the radial cell is definitely rounded apically. In ASHMEAD's table, based probably only on nearctic species, the ♂ of *Habropoda* is said to have the front coxae armed with a long spine and the basal joint of the anterior and posterior tarsi much dilated, but in Malaysian insects (and probably in Indian forms as well) the anterior coxae are unarmed and the basal joints of the anterior and posterior tarsi are not dilated, the posterior basitarsi even less so than in most *Anthophora* males. In SCHMIEDEKNECHT's „Hymenopteren Mitteleuropas“, *Habropoda* is treated as a subgenus of *Anthophora*, and so it was by MAEDE-WALDO, but ALFKEN considers it a valid genus; STRAND (*Suppl. Entom.*, Berlin, 2, 1913, p. 51) leaves its generic status undecided in view of the fact that in the Formosan species, *H. tainanicola* STRAND, the wing-venation was found to be slightly variable: „Die Art muss wohl für eine *Habropoda* gehalten werden, wenn auch das Geäder nicht konstant wie bei dieser Gattung oder Untergattung ist: bei dem einen Exemplar ist die erste rekurrente Ader interstitial, bei den übrigen mündet sie in die zweite Cubitalzelle ein, aber allerdings ganz nahe der zweiten Cubitalquerader“.

The two Malaysian species of *Habropoda* here described are similar in general appearance to the regional forms of *Anthophora*, but apart from the venational feature mentioned above, differ from that genus in the following points.

♀. Body less compactly built, prothorax longer, and more rounded anteriorly, the head appearing more loosely attached to the thoracic

segments, metathorax slightly narrower posteriorly, the propodeum distinctly less broad. Head with the face longer, clypeus longer and comparatively more prominent; ocellar triangle longer, distance between posterior ocelli less than two times that between anterior ocellus and each of the posterior ones. Distal half of mandibles with two blunt teeth along inner margin (one sub-apical tooth in *A.*) ¹⁾. Legs of slender build, less densely pubescent than in most *Anthophora*, posterior tibiae slender, much less expanded at apex, posterior basitarsi elongate, the sides sub-parallel; scopal pubescence on the outside of hind tibia sparse, of basitarsus dense; patella short, subcordate or tongue-shaped, hairless, margins thickened and slightly raised; claws with distinct empodium (absent in *Anthophora*). ²⁾

Wings comparatively longer and more pointed than in *Anthophora*; venuration very similar, but second cubital cell more nearly quadrate, the first and second cubital cross-nerves sub-parallel; nervulus interstitial in anterior wing (shortly antefurcal in *Anthophora*) ¹⁾, widely antefurcal in posterior wing.

Abdomen subcordate, rather more depressed, pubescence short and sparse, only the apical and lateral margins of the tergites densely clothed with appressed pubescence, these hairs forming narrow fasciae.

♂. Similar to the ♀, but abdomen decidedly narrower, much longer than wide, with cylindrical segments and pointed apex, the tergites more strongly arched than in the ♀ of *Habropoda* and both sexes of *Anthophora*. Anterior and intermediate legs normal; posterior legs strongly modified; coxae enlarged, incrassate; trochanters with a blunt, angular ventral projection, the posterior face flattened; femora robust, greatly swollen, their inner faces smooth and concave; tibiae also incrassate, strongly widened towards apex which is produced on the outside into a large, sharply ridged, blunt process, triangular in outline and cross-section, the inner and outer faces smooth and concave; posterior basitarsi with parallel sides, long and slender, not modified. Seventh abdominal tergite triangular, strongly tapered apically; 6th sternite broadly triangular, the apex produced and bluntly pointed; 7th and 8th sternal plates well-developed, though very small. Genitalia as described for *H. impatiens*, sp. n. The genital apparatus as a whole much larger in size than in *Anthophora*.

I have prepared the following — somewhat lengthy — descriptions of the two sexes of *H. impatiens*, and of the ♀ *erratica*, chiefly on account of the fact that not one of the existing descriptions of *Habropoda* is detailed enough to obtain a clear picture of its general appearance and of the chief morphological characteristics. Moreover, *H. impatiens* (and

¹⁾ These characters I have not found mentioned by previous authors.

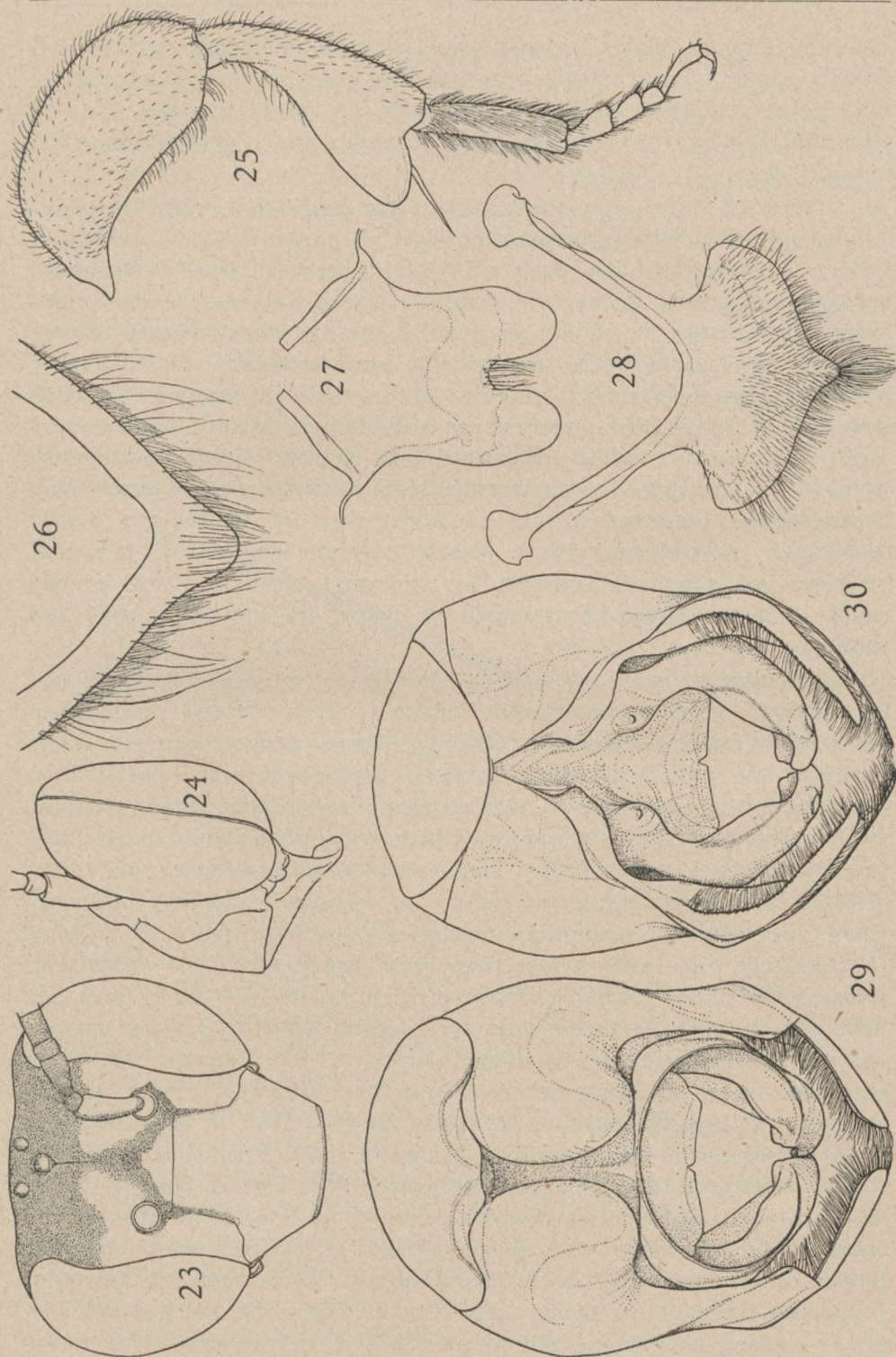
²⁾ Malaysian species.

erratica as well) differ from most previously known species of the genus in being much less hairy insects; apart from this, *impatiens* is also extremely variable in regard to colour of the abdomen. Therefore it was deemed advisable to give detailed descriptions of them and to publish some photographs of the two sexes, which may greatly facilitate their recognition.

Habropoda impatiens, sp. n. (pl. 42 fig. 5-7; textfig. 23-31).

Material studied. — Sumatra: 33♂, 7♀, South Sumatra, Lampoeng residency, Giesting, foot of Mt. Tanggamoos, (600 m, ult. xii. 1939 (13♂), and 21 & 27-29.iii.1940 (20♂, 7♀), Mrs. M. & M. A. LIEFTINCK, on flowers of *Impatiens* cf. *oncidoides*. 1♀, West Sumatra, Benkoelen residency, Pagaralam, foot of Mt. Dempo, 750 m, 23.v.1935, Mrs. M. E. WALSH (in coll. J. VAN DER VECHT). Holotype ♂ and allotype ♀: Mt. Tanggamoos, 27-29.iii.1940, Mrs. M. & M. A. LIEFTINCK.

♀. **Structure.** — Labrum shaped much as in *Anthophora*, strongly convex in frontal view, the upper surface almost flat in profile view, in dorsal aspect a little wider than long, broadened after the middle, the lateral expansions strongly folded down, apical margin slightly produced mesad, but all angles rounded. Face long and narrow, seen from side somewhat less projecting than the diameter of the eye; clypeus distinctly longer than labrum, evenly convex in profile view, with a low median impunctate carina. Surface of labrum rather shining, microscopically wrinkled, sparsely and superficially punctured, the punctures pit-like, placed in the long axis, much smaller than the interspaces, basal tubercles rounded, without punctures; clypeus slightly shining, surface finely rugose, densely covered with large, elongate longitudinal, shiny pit-like punctures which are separated by their own width on disk of clypeus, but become confluent towards apical margin so as to form a number of shallow grooves, separated by longitudinal ridges. Lateral portions of face dullish, finely rugosely wrinkled and with a few scattered punctures towards mesal border of each. Mouth-parts *Anthophora*-like; galea very long, ensiform, almost as long as head and thorax together; glossa when extended about $1\frac{1}{2}$ times longer than galea; apical joints of labial palpi extending slightly beyond galea; maxillary palpi thin and slender, proportionate length of separate joints 14, 45, 35, 22, 14, 11. Mandibles almost smooth, with an additional small tooth-like projection situated at some distance before the larger intero-apical tooth; malar space narrow. Frons dull, densely punctured, the punctures pit-like but smaller than those on clypeus; vertex shining, laterally superficially and finely, above more sparsely punctured with smooth areas between and around ocelli. Antennae moderately long,



Habropoda impatiens sp. n. Lampongs, S. Sumatra.

attaining tegulae, shape normal; scape coarsely punctured, pedicel and flagellar joints microscopically punctate; 3rd antennal joint much shorter than scape and about as long as 4th and 5th joints together, the 4th somewhat shorter than 5th, last joint straight, much longer than wide, its apex flattened, rounded.

Thorax of simple structure; surface generally dull except on mesonotum and mesopleurae; mesoscutum with a fine but distinct, impressed, median longitudinal line and with very short, likewise impressed, parapsidal furrows, its surface shining, evenly and very finely superficially punctured, the punctures smaller than the interspaces; tegulae sparsely finely punctured; mesopleurae and scutellum more densely punctured than mesoscutum, scutellum with a shallowly impressed median longitudinal furrow, the punctures on scutellum numerous, separated by about one puncture width; postscutellum narrow, finely transversely wrinkled; axillae sparsely finely punctured; metapleurae and propodeum evenly densely punctured, pits on upper part of propodeum nearly contiguous; propodeum with a smooth median longitudinal line that broadens out gradually towards the enclosure beneath which is only small, diamond-shaped or roundish in shape, its surface smooth and shining.

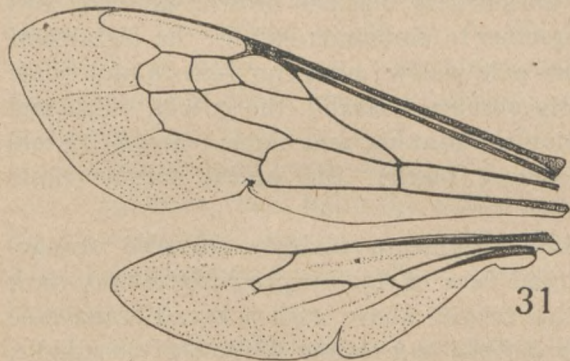
Legs normal; coxae of anterior legs slightly twisted, with a distinct longitudinal groove posteriorly, anterior faces densely punctured. Trochanters and femora smooth, shining; femora slender, sparsely, finely punctate, the punctures most numerous posteriorly near base and on outer faces near apex; tibiae microscopically tuberculate, those of intermediate legs moderately incrassate, a little wider than femur, inner faces smooth, concave, with a robust longitudinal carina; anterior and intermediate tarsi normal, exterior surface of metatarsi similarly but more finely and sparsely tuberculate. Posterior tibia long and very slender, four and one half times longer than its width at apex, not wider than femur, sides almost parallel, almost straight, inner and outer faces but little convex, inner surface evenly very densely punctured, outer surface smooth, entirely covered with small, black, wart-like tubercles which are separated from each other by about four times their own width; patella conspicuous, broadly cordate, distinctly shorter than it is wide along base, one-sixth to one-seventh as long as tibia. Posterior basitarsus slightly narrower than tibia and little more than half as long, elongate, sides parallel, slightly less than three times as long as it is wide, its outer surface covered with large pit-like punctures, apex obliquely truncated but only slightly produced above into a roundish tubercle; remaining tarsal joints much narrower, the 2nd joint widened apically, amply as long as 3rd and 4th joints together, apical joint slender, the claws comparatively short with a small interior tooth situated about

half-way its length; pulvillus well-developed, rounded apicad.

Wings (fig. 31); posterior wing with about 18 frenal hooks.

Abdomen shaped as described *antea*, dorsal surface dull; tergites 1-4 evenly closely punctured, the punctures generally not separated by more than one or two punctures width, posterior margins of tergites narrow, straight, only very slightly depressed, their surface dull, more sparsely and superficially punctured than the rest. Surface of 5th tergite densely irregularly granular-punctate. Sixth tergite with the (unexposed) basal portion transversely microscopically reticulate, surface of exposed portion with large pit-like punctures; pygidial plate tongue-shaped, only little longer than broad at base, apex broadly rounded; this plate slightly downbent at extreme base, margins not raised, the unexposed part finely transversely striate, the exposed part straight, its surface very slightly convex, dull, microscopically rugose. Ventral surface of abdomen rather shiny. First sternite sparsely finely punctate, its surface almost polished,

but on closer examination microscopically reticulate; 2nd-5th sternites divided transversely into a pale-coloured basal and a black-coloured distal portion; anterior margin of 2nd and 3rd sternites with a small median emargination, which is broadly U-shaped on 2nd, reduced to a feeble crescent-shaped ridge on 3rd sternite; anterior divisions of 2nd-5th



Habropoda impatiens sp. n.

sternites microscopically reticulate, the posterior divisions rugose, irregularly punctured, the punctures scattered and of various size; 6th sternite tapered apicad, the apex rounded, surface microscopically reticulate with some scattered punctures intermixed at extreme base, the distal $\frac{3}{4}$ of this sternite densely covered with pit-like punctures which become contiguous and confluent towards apex.

Colour. — Head and thorax black. Mouth-parts pale ferruginous, the galeae unicolorous light ochraceous, glossa ferruginous. Malar space glossy brownish-black. Mandibles bright yellow with a greenish tinge basally, then turning to ferruginous, the apical third shading to chestnut colour or almost black. Labrum, clypeus and lateral portions of face (the latter with a short orbital extension beyond level of antennae) bright lemon-chrome to light cadmium; anterior margin of labrum and labro-clypeal suture narrowly ferruginous, the basal tubercles of the former more ochraceous; orbits finely black. Clypeus with two elongate, longi-

tudinal, black patches, each very slightly expanded and somewhat obliquely truncated anteriorly, on each side of the median line, occupying the basal three-fourths of clypeal length; these patches separated by a narrow yellow median stripe which is continued upwards for a short distance beyond the black fronto-clypeal suture so as to form a slightly expanded, diamond-shaped spot on the area frontalis. Frons and vertex black, frons with a large roundish, ill-limited, dirty greenish-yellow fleck on each side immediately behind the antennal sockets. Antennae, including the scape, brownish-black or black, anterior faces of flagellar joints (except the first) more or less distinctly ferruginous. Thorax entirely black except a narrow brown sutural line between scutellum and post-scutellum, the axillaria of the wings, and the tegulae, which are bright ferruginous.

Wing-membrane strongly tinged with greyish-yellow (dirty ochraceous-buff), the nervures blackish-brown.

Legs with the coxae and trochanters blackish-brown; anterior two pairs of legs unicolorous ferruginous to cinnamon-rufous, the distal half of claws and pulvilli black; spurs pale yellow; posterior femora and tibiae also ferruginous, femora slightly obscured basally, the patella black and the spurs pale yellow; posterior metatarsus and next (second) tarsal joint dark blackish-brown (almost black), the apical tarsal joints ferruginous, claws as before.

Abdomen mainly black, basal segments variably coloured orange-rufous. Allotype: anterior vertical face of 1st tergite black aside, dark orange-rufous in the middle, this tergite above with a broad transverse band of that colour, not sharply defined and rather obliterated on middle, followed by a brownish-black band along and close before posterior margin which tapers away on either side, the rufous colour of the sides encroaching on along posterior margin half-way towards middle of segment; basal two-fifths of 2nd tergite also orange-rufous, more broadly and brightly so aside, this band not sharply defined behind and gradually shading into black posteriorly; apical margin also obscurely orange-rufous, especially aside; 3rd to 5th tergites black, the apical and latero-ventral margins of each narrowly and obscurely yellowish; 6th tergite black, the unexposed part of the sides and of the pygidial plate chestnut-coloured, the exposed portion of the plate black. Sternites 1-5 with the anterior portions entirely and the lateral expanded divisions partly, clearly defined orange-rufous, the posterior divisions black, apical margins narrowly but distinctly, dirty brownish-yellow in colour; 6th sternite brownish-black.

In four paratypes the orange-rufous ground-colour of the abdomen is considerably more extensive: 1st and 2nd tergite, including the sclerites, entirely light-coloured with the exception only of a small,

transverse blackish dot on either side — far apart — near posterior margin of each tergite (obsolete in one ♀); 3rd tergite in three out of four specimens with lateral streak of the same colour along base of segment and with the lateral expansion of the sternite also orange-rufous. Lastly, two females are intermediate between the type and the paratypes just mentioned, in that the dorsum of the 1st segment only bears the lateral black dots, whilst the basal half of the 2nd is more or less sharply defined rufous in colour. The colour of the sternites in these specimens varies correspondingly.

Pubescence. — Labrum and clypeus sparsely clothed with long, robust, erect hairs rising from the pit-like punctures, hairs mainly dark brown, those on labrum longest, light brown; lateral portions of face almost nude, the scattered hairs short and yellowish. On mandibles a row of very long, arcuate hairs along exterior margin and a similar row of sparse and somewhat shorter hairs along interior margin. Maxillar palpi nude, the second joint with an outer row of short pale hairs, few in number, which are hardly twice as long as the diameter of the joint itself. Long, soft pubescence on underside of head and behind the eyes dense, strongly plumose, not entirely concealing surface, greyish-yellow laterally and beneath, orangish on occiput; hairs immediately behind outer orbits short and dense. Frons sparsely clothed with long, erect, black hairs not concealing surface, hair on vertex longer but more scattered, arcuate; hair on scape of antennae rather long, dark, dorsally glistening golden-yellow, tipped with black; remaining joints hairless.

Pubescence of legs sparse, ochraceous-orange to orange chrome; hair on coxae and trochanters short, pale orangish; on anterior femora rather dense and feathery posteriorly, longer basally than diameter of femur; intermediate and posterior femora with short sparse pubescence; inner faces of anterior tibiae nude, of intermediate tibiae with short appressed hair, outer faces of middle tibiae more densely pubescent, the anterior ridge with a dense patch of short, velvety, bright salmon-orange hairs; pubescence on inner side of posterior tibiae short and dense, semi-erect, not concealing surface, scopal and marginal hairs ochraceous-orange, long, slightly plumose, not very dense and not obscuring surface. Pubescence on inner side of anterior and intermediate basitarsi short and recumbent, rather felt-like, bristles on following tarsal joints orange-rufous; long sparse hairs on outer face of posterior basitarsus ochraceous-orange shading to chestnut colour distally, pubescence on the inside very dense, felt-like, orange-rufous, apical hairs dark brown; penicillus fan-shaped, dark brown (golden-brown in certain-lights), tips of hairs glistening silvery-white.

Thorax with abundant erect, strongly plumose, marse-yellow hair,

not mixed with black, not very long above and not entirely obscuring surface; this pubescence distinctly longer and also denser on postscutellum and, more especially, on sides of propodeum; hair on sides of thorax slightly paler, rather longer than on dorsum but much less dense, not concealing surface. Pubescence on propodeum restricted to the sides, the vertical, rather rectangular, surface with very short, appressed pale brownish tomentum, the enclosure and punctured area around it hairless.

Pubescence of abdomen sparse; 1st tergite with tufts of rather thin and long, erect, yellowish hair, longest on both sides and restricted to the anterior part of the segment, for the rest thinly covered with very short, pale ochraceous pile, apical margin on each side of the middle with a row of more conspicuous but very short, appressed, golden yellow, bristle-like hairs; pile on tergites 2-4 sub-erect, rather dense, excessively short, mainly dark, dorsally intermixed with slightly longer, scattered, erect black hairs, successively longer posteriorly, each of these segments moreover with a narrow band of dense appressed glistening light golden-to silvery-yellow pubescence along apical margin, these bands more or less obliterated or replaced by short blackish hairs in the middle, the apical fascia of 4th tergite always complete; 5th tergite with short black pubescence, the hairs on apical part of dorsum and sides longer, erect, the distal margin with a dense fringe or long black bristles; exposed portion of 6th tergite with similar, strong black bristles, the pygidial plate hairless. Sternites nude, but the apical portion of the posterior divisions with scattered yellowish pubescence and the apical margin of sternites 2-5 each with a sparse fringe of long, erect, slightly plumose, light golden-yellow hairs, the hair-fringe of 5th sternite with dark brown hairs intermixed; 6th sternite with an apical tuft of blackish hairs.

♂. — Structurally very similar to the ♀, differing as follows: — Clypeus more prominent with the dorsal line in lateral view decidedly more convex (fig. 24); antennae slightly longer, reaching a little beyond tegulae; 3rd antennal joint distinctly shorter than in ♀, about half as long as scape, much shorter than 4th and 5th together and only about twice as long as 4th joint, the 5th one and one-fourth as long as 4th.

Anterior and intermediate pair of legs not modified, slightly more slender than in the ♀, posterior leg as described *antea*: the trochanter more compressed, produced posteriorly into two rounded prominences which give it a saddle-shaped appearance; femora greatly inflated, their posterior faces smooth and concave and bounded on either side by a short rounded carina; tibial process shaped as shown in fig. 25; posterior basitarsus much slenderer than tibia, almost five times as long as wide, parallel-sided. Anterior coxae coarsely sparsely punctured, puncturation of posterior two pairs of coxae very fine and dense; surface of anterior femora dull, sparsely covered with fine black warts, inter-

mediate femora more shiny, surface microscopically reticulate, the black warts fine and scattered; posterior femora, inner faces moderately densely, finely punctured, outer faces sparsely punctured; posterior tibiae densely punctured on the inside, outer surface microscopically wrinkled and with fine, scattered, black warts which are most numerous posteriorly near base, the apical process almost nude.

Abdomen elongate-oval, tergites strongly arched, sternites not modified. Tergites less densely, more finely and more superficially punctured, the punctures generally separated by about 4-6 punctures width, surface accordingly decidedly more shining than in the ♀; posterior margins of tergites simple, straight, broader than in ♀, their surface microscopically chagreened, almost impunctate. Exposed surface of 6th tergite superficially reticulate with scattered black warts, surface of 7th tergite slightly convex in profile view, rugose and with the black warts more numerous, its apex somewhat produced, rounded, very slightly upcurved (fig. 26). Sternites rather shining, their surface microscopically reticulate.

Seventh and 8th sternal plates (outer and inner spathae) small, shaped as shown in fig. 28 and 27, ventral surface of apical lobe of 7th sternite hairy distally, the produced apex with long hair; 8th sternite with some plumose and normal hairs along inner margin only.

Genital apparatus of comparatively large size, orange-yellow in colour. Dorsal plate at base of penis very small, membranous, not concealing sagittae, in the form of a transverse, trapezoidal connectiva with straight distal margin. Basal ring (lamina annularis) small; laminae paramerales (basiparameres) smooth and shining, greatly swollen, the broadly rounded dorsal lobes at first closely approximated, then narrowed, concave interiorly, and in the form of thin, vertical lanceolate blades, each giving rise to a slender, incurvate paramere, which consists of two branches; the distal portion of the outer branch, after being constricted, is greatly expanded in posterior view, with the pale yellowish tips subrotundate; interior branch shorter and of slenderer build, finger-like, hollowed out interiorly, invisible in dorsal view, for the most part concealed under and fitting close to the outer branch, apices tapered and narrowly rounded; both pairs of valves densely fringed with pale-coloured marginal setae. Sagitta nude, shape as shown in fig. 29-30, little shorter than parameres but more forcipate, strongly hollowed out interiorly with almost incurled, abruptly truncated apices, the lower angle of each produced ventrally into a short triangular process, which is just visible in profile view.

Colour. — Head with the mouth-parts as in ♀; the entire anterior surface, including the mandibles (except the apices and the interior projections which are chestnut-coloured), bright apricot-yellow, the

labrum slightly paler, its anterior border and the labro-clypeal suture finely ochraceous. Clypeus and frons marked with black as is shown in fig. 23, the pale marks on frons between antennae slightly larger and better pronounced than in the ♀, but of a dirty yellowish tint. Antennae with the anterior face of the scape also bright yellow, posterior face amber brown; pedicel and 3rd antennal joint dark brown, the apex of 3rd joint more or less ferruginous; flagellar joints brownish-black or black, with the anterior faces of a dull greyish- or buffy-olive tint, this colour brought forth by an extremely dense microscopical scaling, covering the entire surface.

Thorax and wings as in the ♀, the wing-membrane slightly more flavescent.

Legs with the coxae reddish-black or black, trochanters mainly dark, rufous posteriorly; femora, and tarsi deep chrome, tibial spurs pale yellow, teeth of tarsal claws black; basal half of outer face of femora and extreme base of tibiae on the outside diffusely blackish; posterior basitarsi brownish-black or black (all individuals), remaining tarsal joints more or less obscured exteriorly.

Abdomen extremely variable in colour. In 18 out of 33 males the abdomen is predominantly „red” ¹⁾, with the transverse black bands on tergites 1-3 or 1-4 reduced to mere points on each side of the segment or absent altogether, and with the apical segments variegated with black to some extent, whilst in 15 others (including the type) the segments are predominantly „black” in colour. A description of these colour-modifications may be given as follows: — Red extreme. — Abdomen entirely red, darkening somewhat towards apex, the apical margins of all segments rather paler, orange-yellow, but the limits indistinct; vertical face of 1st tergite with a wide horseshoe-shaped black mark, open above, at extreme base, the branches curved inwards and tapering dorsally; 1st to 5th tergite each with a pair of small, ill-defined, widely distant, blackish transverse dots or streaks, situated half-way their length, those on 1st and 2nd tergite vestigial; successively larger on following segments but the streaks on 5th more widely apart than their own length (width) and the interspace slightly obscured; 6th tergite with the basal half diffusely black (somewhat obliterated in middle), the apical half red; 7th tergite black; the light colour of tergites 3-5 slightly (transversely) obscured in middle; sternites red, but of a paler tint than the tergites, 2nd-4th sternite each with a diffuse dark greyish transverse dot on each side of the middle, 5th and 6th with transverse median streaks of the same colour along base.

Black extreme. — First tergite black, with a moderately sharply

¹⁾ In freshly killed and rapidly dried examples the „red” body-colour is a mixture of RIDGWAY's „orange-chrome”, „orange-rufous”, and „apricot-orange”.

defined apical band of a dirty pale orangish tint, occupying about the distal half of the horizontal portion of the tergite; 2nd-5th tergite also black, each with similar but much narrower apical marginal pale bands, which are not sharply defined anteriorly and become successively narrower posteriorly, those on 4 and 5 being linear and transparent in certain lights. In all specimens the black colour on dorsum of abdomen shows distinct purplish and steely blue reflections in certain lights. First and 2nd sternites reddish, each with a transverse median greyish-black band of variable width, the lateral expansions mainly red; 3rd to 5th sternites dark brownish or reddish-black, the pale posterior margins of the same width as on the tergites; 6th sternite reddish-black.

The type (and 3 paratypes) of *H. impatiens* is almost exactly intermediary between the two extremes described above: 1st tergite red, black basal mark as in the red extremes but larger, 2nd with the transverse black dots enlarged and confluent across middle of segment so as to form a transverse undulated fascia which is triangularly produced in the median line; black band on 3rd tergite occupying its basal two-thirds, those on following segments successively wider; sternites of basal segments mainly red. About 6 intermediates, none of them alike, are available for comparison with the typical male (4 specimens) and the black extreme (6 specimens), but most of these red-bodied insects are nearer the red extreme than the type: in all red males the first three abdominal tergites bear isolated black lateral dots, although the apical segments vary much in colour. It is interesting to note that even in the light colour-variety (including the red extreme) the body-tegument shows low but distinct purplish and bluish reflections in certain lights.

Pubescence. — Hair on labrum and face shorter and more scanty than in ♀, light golden-yellow on labrum, dark brown with golden reflections on clypeus; pubescence on dorsal surface of head generally paler and less dense; long soft pubescence on underside dense, almost white.

Hair on anterior and middle pair of legs similar to the ♀; trochanters of intermediate pair on their ventral surface clothed with a felt-like patch of short, extremely dense, velvety hairs of a dark golden-brown colour. Pubescence on outer faces of posterior femora short and sparse, semi-erect, that on inner faces sub-appressed, much shorter and somewhat denser than on the outside but not concealing surface; flattened posterior faces almost nude; hair on posterior tibiae slightly longer than on femora, the large triangular projection hairless; pubescence on posterior tarsi much as in the female but hairs on outer face of basitarsus finer and denser, more appressed though not concealing surface.

Pubescence of thorax as in the ♀, the plumose hairs on mesonotum somewhat longer, obscuring most of the surface, but on postscutellum

and propodeum much longer and more flocky than in the opposite sex, some plumose hairs on each side of propodeum hiding basal third of 1st abdominal segment.

Pile on abdomen quite similar to the ♀ except that the 5th tergite, like the three foregoing segments, has a conspicuous apical fringe of pale golden- or silvery-yellow hairs, these marginal hairs are longest laterally and usually somewhat interrupted in the median line; 6th and 7th tergite clothed with moderately long, bristle-like blackish hair, those on 7th appressed and much shorter than on 6th except marginal fringe of black hairs; sternites with scanty pubescence, the marginal fringes distinctly longer than in the ♀; 6th sternite clothed with short appressed pale brown pubescence, the apex with a tuft of long, golden-yellow hairs.

♂. Length 16.0, greatest width of abdomen 4.5, anterior wing 10.2 mm (holotype); 13.4-16.2, 4.2-4.9, 9.7-10.3 mm (paratypes). ♀. Length 16.2, greatest width of abdomen 5.2, anterior wing 10.0 mm (allotype), 14.3-16.0, 4.9-5.3, 9.4-10.2 mm (parallotypes).

Of the 13 or 14 oriental species of *Habropoda* which I know from notes or descriptions in the literature, there is not any that fits this new Sumatran species. It is the first *Habropoda* known to occur in the Sondaic islands and seems to come nearest to the new Javan species *H. erratica*. CAMERON's *H. fulvipes*, according to COCKERELL (*Ann. Mag. Nat. Hist.* (9) 20, 1927, p. 530-531) is a composite species, but his notes are not very clear and the original description is not known to me. The ♂ of *impatiens* tallies the description of *H. percarinata* CKLL (*Ibid.* (10) 6, p. 51), ♂ from Foochow, China, fairly closely; but the trochanters of the posterior legs are not pointed apically, and the clypeus is not strongly keeled down the middle; the posterior tibiae of *percarinata* are simply described as having the „apex broadened”, whereas in *impatiens* they bear a very conspicuous triangular lamella. No mention is made of the genital organs of *percarinata*.

On Mt. Tanggamaes *H. impatiens* was strictly confined in its visits to one particular kind of flower, viz. a wild Balsam, *Impatiens* cf. *oncidoides*, with large yellow flowers carrying long curved spurs. Patches of this hygrophilous plant were found in damp shady situations, chiefly in trenches and other gloomy places beside the long-abandoned track on the edge of the dense virgin forest. Once arrived there we were soon struck by the shrill note of *impatiens* which flashed hither and thither among the low herbage. The males kept up a continual flight over the flowers which only the females searched for honey and pollen; the males greatly outnumbered the females and alighted only rarely in sunlit openings, on leaves or tiny branches; they were exceedingly alert and difficult to capture when ranging over the flowers in search of the females. Curiously enough, the insects were most abundant when the

weather was dull and were active even when it was raining. Although common in this restricted habitat and possibly breeding gregariously, we have been unable to find the nests.

H. impatiens is probably the host of *Callomelecta vulpecula*, which was captured in the same locality and on the same days.

Habropoda erratica sp. n. (pl. 42 fig. 8):

Material studied. — Java: 1 ♀ (holotype), West Java, Buitenzorg residency, Telagawarna (Poentjak pass), 1450 m, 4.vi.1939, on flower of *Impatiens chonoceras*, M. A. LIEFTINCK.

♀ (holotype). — Structurally very much like *impatiens*, but differing as follows:

Vertex more densely punctured, with no impunctate area on either side and between ocelli, this area finely striate-punctate. Third antennal joint about three-fifths as long as scape and very little shorter than 4th and 5th joints together, the 4th about five-seventh as long as 5th. Mesonotum moderately shining, more strongly and coarsely punctured than in *impatiens*, the interspaces about one puncture width; tegulae smooth, superficially excessively finely punctured; scutellum with a distinct, impunctate, median longitudinal carina.

Legs decidedly more slender than in *impatiens*; femora not distinctly punctate; anterior tibia and basitarsus very thin, the former not or scarcely incrassate; intermediate tibia much narrower and less inflated than in *impatiens*, but wider at apex than femur. Posterior legs extremely slender, tibia compressed, longer than in *impatiens* (almost five times as long as it is wide at apex), not at all inflated; patella conspicuous, shaped as in the preceding species. Posterior basitarsus elongate, amply three times as long as it is wide and about as wide as tibia at apex, sides parallel. Pulvillus distinct.

Wings as in the preceding species.

Abdomen slightly more superficially and finely punctured than in *impatiens*, otherwise quite similar to that species. Pygidial plate shaped and sculptured almost exactly as in *impatiens*, the apex almost truncated. Sternites rather shiny, but punctures on posterior divisions of sternites larger and deeper; sculpture of apical sternites not different from *impatiens*, the 6th slightly more tapered apicad.

Colour. — Labrum not entirely yellow; the sides obscured, dirty ochreous fading to dark brown, the anterior border finely ferruginous. Clypeus entire black, save for a fine, citron-yellow, median longitudinal stripe, which does not quite reach the anterior margin and which is continued upwards for a short distance beyond the fronto-clypeal suture so as to form a yellow point on the area frontalis; there is, in addition, an isolated, yellow point situated just above the malar space in front of

the suture between clypeus and lateral portions of face. Lateral portions of face black, with a triangular yellow spot along the eye-margin, this spot covering approximately the lower half of this area. Head otherwise entirely black. Antennae black, the flagellar joints dark brown on their anterior faces.

Thorax black, tegulae ochraceous-tawny.

Wing-membrane greyish-hyaline, disk of anterior pair very slightly flavescent, the nervures blackish-brown.

Legs, including the basitarsi, unicolorous dark chestnut-brown; tibial spurs pale (yellowish-hyaline), remaining tarsal joints dark ferruginous, the distal half of claws and pulvilli black.

Abdomen black, disk of 3rd and 4th tergite with very low metallic shine. A narrow transverse band along base of horizontal part, and the sides of 1st tergite (both ill-defined), dirty cinnamon-rufous; apical part of this tergite moreover with very indistinct, narrow, transverse band before posterior margin, this fascia rather curved, convex anteriorly, and of a dirty ochraceous-tawny colour; 2nd to 4th tergite each with indications of similar but much smaller transverse, crescent-shaped apical bands, all very indistinct and not sharply delimited; apical margins of tergites 1-4 dirty cinnamon-coloured (mostly concealed by the brightly coloured apical hair-fringes). Sternites dark reddish-brown to black, the bases of sternites 1 and 2 paler (the 1st broadly cinnamon-rufous), apical margins of 2-5 sharply defined ochraceous-tawny; 6th sternite brownish-black, its base tawny.

P u b e s c e n c e. — Body generally more sparsely pubescent than in *impatiens*, especially so on dorsum of thorax and on the legs. Hair on mandibles and labrum golden-yellow, those along outer margin of mandibles not numerous but very long, about twice as long as basal width of mandibles; hair on face and dorsal surface of head brownish-black and black, frons with small tufts of pale brown hair behind antennal sockets; scape of antennae with black and light brown hairs intermixed. Long, soft pubescence on underside of head and behind the eyes, greyish-white laterally and beneath, black on occiput; hair behind outer orbits short and scanty. Pubescence of legs very sparse, varied; on coxae, trochanters and femora very short, pale ochraceous, but on anterior femora longer and denser, feathered posteriorly; hair on anterior tibiae ochreous, intermixed with black apically, on intermediate tibiae dark brown tipped with ferruginous, their inner faces hairless; pubescence of posterior tibiae still shorter and less dense than in *impatiens*, appressed hairs on inner faces short and dense, pale orange-yellow, the interior longitudinal carina with a fringe of dark brown hairs, scopal hairs on outer surface dark brown at extreme base and apex and around the patella, for the rest bright ochraceous-orange, a few of them black. Pubescence on inner side of

anterior basitarsus golden-yellow, on intermediate one burnt-sienna, on outer faces of both dark-brown; long hairs on posterior basitarsi and penicillus dark brown, dense appressed pubescence on the inside unicolorous sanford's brown. Hair on remaining tarsal joints orangish.

Thorax clothed on mesonotum and scutellum with erect, strongly feathered, greyish-black pubescence, sparsely intermingled with cinnamon-buff hairs, this pubescence moreover not so dense as in *impatiens*, not concealing surface; plumose hair on postscutellum and on sides of propodeum decidedly longer and more dense, ochraceous-buff without mixture of black hairs; hair on thoracic sides rather paler, much less dense, on propodeum similar to *impatiens*.

Pubescence of abdomen sparse; 1st tergite with tufts of long and thin, erect, ochraceous-buff hair, similar to *impatiens* but denser; apical margin with a dense fringe of very short, appressed, golden-yellow hair; pile on tergites 2-4 sub-erect, rather dense but excessively short, black, with a few scattered erect black hairs intermixed, each of these segments with a narrow apical band of dense appressed glistening golden-yellow pubescence, that on 2 obliterated in the middle, but seemingly complete on account of the pale apical margin; 5th tergite clothed with long and dense, sub-appressed black hairs and with a dense fringe of still longer apical hairs; exposed portion of 6th tergite with similar, strong black bristle-like hairs, the pygidial plate nude. Pubescence of sternites similar to *impatiens*, the apical fringe of erect, arcuate hairs of 2-5 longer and more crowded together, very conspicuous as viewed from side, and of a glistening, light golden-brown tint, the hair-fringe of 5th sternite rufous.

Length 14.0, greatest width of abdomen 5.0, anterior wing 9.2 mm.

This interesting new species is the first of its genus to be reported from Java. It is doubtless nearly allied to the Sumatran *H. impatiens* and the females resemble each other very closely in general appearance. Besides being of smaller size, the ♂ of *H. erratica* is easily distinguished from that of *impatiens* by the reduced yellow face-marks, the darkly coloured legs, and in having the pale pubescence on dorsum of thorax intermingled with greyish-black hairs. It differs further in having the abdomen almost wholly black instead of black variegated with bright orange-rufous on the basal segments. Unfortunately, the of *erratica* is not yet known, but we may expect an insect resembling *impatiens*, with similarly modified hind legs.

Genus *Anthophora* LATR.

No attempt has yet been made to identify the numerous species of *Anthophora* ¹⁾ occurring in the great Malay Archipelago and it is only

1) Although *Lasius* JURINE (1801) has priority over *Anthophora* LATREILLE (1802) and invalidates *Lasius* FABRICIUS et auctt. (1904), I have followed most authors in considering *Anthophora* LATR. a *nomen conservandum*, abandoning the "Erlangen List".

the recent publication of RAYMENT (this journal, 18, 1942, p. 621-647), dealing with the *zonata* cluster of this genus, to which the specialist can turn for assistance in the determination of species belonging to that group.

All forms discussed hereafter, except *A. hanitschi* M.-W., belong to a large group of closely allied species resembling *A. zonata* and allies in general appearance, but differing from these, among other things, in the iridescent scale-like hair-bands on the abdomen being replaced by ordinary fulvous pile or pubescent fasciae of that colour, and also in the absence of a serrated process on the seventh abdominal sternite of the male. These brown or brown-banded *Anthophorae* may provisionally be included in a separate group of which *A. insularis* SMITH seems to be the earliest described species. *A. hanitschi* stands rather apart, but in respect of its conspicuous vestiture and in the structure of its genital organs, appears to be linked with the coppery and green members of the *aeruginosa* tribe of the *zonata* group. The systematic position of *A. bouwmani* sp. n., of which only the ♀ is known, remains uncertain.

As regards general appearance, morphology of mouth-parts, structure of legs, etc., the descriptions of the new species, contrary to those given above for *Callomelecta* and *Habropoda*, will possibly be considered, in some instances, to be incomplete. Apart from the keys, I have endeavoured to give in all cases sufficient information to enable the student to make out his species; it is certainly a mere incumbrance to describe over and over again characters common to every species of the genus: and this paper must be considered merely as an endeavour to supply material for a monograph to be compiled by some future Hymenopterist.

The limited material now before me indicates the existence in Sumatra and Java of at least seven species additional to the six or seven previously known. The latter are only known to me from descriptions, which are all of them totally insufficient, so that it is impossible to recognize the species without examining and dissecting the types.

All regional species of *Anthophora* examined by me agree in lacking a tarsal pad or empodium between the tarsal claws, a character of the nearctic genus (or subgenus) *Emphor* PATTON.

Key to some Malaysian species of *Anthophora*

Males

1. Tergites 1-4 of abdomen mainly clothed with pale (fulvous or green) pubescence or with transverse fulvous pubescent fasciae along apical margins 2
- 1'. Tergites 1-7 of abdomen deep black, mainly clothed with very short sub-erect black pubescence, without transverse fulvous pubescent fasciae along apical margins; 1st tergite with small lateral tufts of

orange rufous hair and some scattered hairs of same colour on dorsum; tergites 2, 3 and 4 with very narrow, appressed, white hair-bands along apical margins, those on 2 and 3 broadly interrupted, that on 4 wider than preceding ones and narrowly interrupted in the middle. Labrum and face yellow, marked with black similarly to *cyrtandrae*. Dorsal pubescence of thorax rich orange-rufous with few black hairs intermixed. Tegulae orange-rufous. Legs black; intermediate and posterior tibiae and basitarsi on the inside clothed with black pubescence, on outer faces of posterior two pairs of tibiae and outer face of intermediate basitarsus light orange-yellow, outer apical hairs of posterior tibia yellow-white; outer face of posterior basitarsus entirely black-haired. Third antennal joint slender, fully two times as long its width at apex, somewhat longer than joints 4 and 5 united (ratio 32:10:16). Sixth abdominal sternite rounded and slightly emarginate; 7th sternal plate gradually widened towards apex, its surface without numerous microscopical hairs. Java **jacobi**

2. Abdomen above entirely clothed with fulvous pubescence (not green in certain lights), or alternately black- and fulvous-haired, with or without pale pubescent fasciae along apical margins. Scopal hairs on outer face of posterior tibia rufous. Tegulae pale-coloured. Sixth abdominal sternite broadly rounded or slightly emarginate; 7th sternal plate gradually widened towards apex, its surface without numerous microscopical hairs 3
- 2'. Abdomen above evenly clothed with short, appressed, rich biscay-green pubescence; with fulvous hairs sparsely intermixed: in dorsal view the abdominal pubescence has a fulvous tinge, viewed from behind it is rich emerald-green. Body black; labrum whitish with a thick black basal stripe and the anterior margin finely bordered with black; clypeus with sharply defined T-shaped spot, a small triangular supra-clypeal mark, and lower half of lateral portions of face, bright lemon-yellow. Long soft hair on lower part of temples snow-white. Dorsal pubescence of thorax olive-green and honey-yellow with numerous black hairs intermixed. Tegulae brownish-black. Legs black, for the most part black-haired, but anterior legs on the outside and intermediate femora with abundant white pubescence intermixed, coxae and trochanters white-haired; pubescence of posterior tibia and basitarsus throughout black or very dark brown, respectively, on upper half of outer face of tibia sharply defined bright orange, the long apical hairs fading to pale orange-yellow. Third antennal joint slender, distinctly more than two times as long as its width at apex and much longer than joints 4 and 5 united (ratio 45:15:20). Sixth abdominal sternite abruptly truncated apically; distal portion of 7th sternal plate abruptly and strongly widened, its

- surface apically clothed with numerous microscopical hairs. Perak, Sumatra **hanitschi**
3. Species of huge size, body-length 20 mm approx. Abdominal tergites black, with very short, sub-appressed, black pubescence, tergites 1-5 with sharply defined, appressed, orange-buff pubescent fasciae along apical margins, these bands becoming gradually broader posteriorly; pubescence on apical segments also pale-coloured. Face strongly protuberant, facial depth greater than diameter of eye. Labrum and face yellow, labrum at extreme base (including the basal tubercles) and apical margin slightly obscured, face marked with black similarly to *feronia*. Long soft hair on lower part of temples pale yellowish. Dorsal pubescence of thorax not very dense, ochraceous-buff with numerous black hairs intermixed. Legs dark russet, pubescence sparse, not conspicuous, between ochraceous-tawny and ochraceous-orange; posterior legs slender. Antennae short, attaining tegulae, third joint short and comparatively robust, less than two times as long as its width at apex, distinctly longer than joints 4 and 5 united (ratio 40:18:17). Sumatra **elephas**
- 3'. Species of smaller size, body not exceeding 15 mm in length 4
4. Legs decidedly pale-coloured, femora and tibiae either ochraceous-tawny or salmon-orange to orange-rufous, femora and basitarsi usually rather darker; pubescence along margins of posterior tibia and basitarsus short. Labrum with the distal margin and a stripe along base at most slightly obscured, not deep black. Clypeus with very distinct, impunctate median longitudinal carina. Long soft hair on lower part of temples white or with distinct yellowish hue. Basal half of mesoscutellum with distinct median longitudinal carina. Marginal pubescence on posterior tibia and basitarsus rather short and sparse, not conspicuous; tibial spurs and pubescence on the inside of posterior basitarsus dark brown. Apex of 7th abdominal sternite with a few short marginal hairs 5
- 4'. Legs black or very dark brown, femora and tibiae at most chestnut-coloured; pubescence along margins of posterior tibia and basitarsus longer and more conspicuous. Labrum pale bluish- or yellowish-white with a sharply defined deep black basal stripe, widening on each so as to include the basal tubercles (these occasionally brown), and with the apical margin at least narrowly bordered with black. Clypeus with low, impunctate median longitudinal carina. Long soft hair on lower part of temples almost or pure snow-white. Basal half of mesoscutellum with median longitudinal carina very weak and poorly developed. Marginal pubescence on posterior tibia and basitarsus longer and rather dense, more conspicuous; pubescence on the inside of posterior basitarsus, and tibial spurs, deep black or almost

- so. Apex of 7th abdominal sternite without marginal hairs 6
5. Surface of abdominal tergites 1-4 rather shining, above evenly clothed with very short, sub-appressed, black pubescence, intermingled with a few short, erect fulvous and black hairs, and laterally gradually replaced by short, sub-erect, fulvous pubescence; tergites 1-4 moreover with distinct though narrow, transverse fasciae of appressed orange pubescence along distal margin, these bands widest laterally and nearly always slightly interrupted in the middle, their anterior limits indistinct. Tegument of abdominal tergites black, sometimes with very low metallic lustre, apical margins broadly ochraceous-tawny, distinctly showing through the pubescence in worn specimens. Labrum buff-yellow to light orange-yellow. Long soft pubescence on lower part of temples light orange-buff. Hair on clypeus blackish-brown with golden reflections. Dorsal pubescence of thorax between bright xanthine-orange and orange-rufous, sparsely intermingled with black hairs. Legs with all tibiae bright orange, for the rest mainly mars-brown or chestnut-brown; pubescence pale, mostly orange, on posterior femur and tibia partly, and on inner face of posterior basitarsus, dark brown. Third antennal joint very short and broad, scarcely $1\frac{1}{2}$ times as long as its width at apex, much shorter than scape and a little shorter than joints 4 and 5 united; 4th joint much shorter than 5th (ratio 28:11:19). Java **feronia**
- 5'. Surface of abdominal tergites 1-5 dull, above evenly and densely clothed with short, sub-appressed, ochraceous-tawny to buckthorn-brown pubescence, the hairs more numerous and a little longer towards apical margin but not forming transverse pubescent fasciae. Tegument of abdominal tergites brownish-black, almost black, the apical margins very broadly tawny, thus accentuating the pubescence. Labrum milky-white to light yellow. Long soft pubescence on lower part of temples white. Hair on clypeus black. Dorsal pubescence of thorax mainly ochraceous-buff with numerous black hairs intermixed. Legs with all tibiae ochraceous-tawny or pale ochraceous-orange, for the rest coloured much as in *feronia*; pubescence pale, ochraceous-tawny, slightly more orangish on posterior tibiae, otherwise as in preceding species. Third antennal joint more slender, almost two times as long as its width at apex but somewhat shorter than scape, a little longer than joints 4 and 5 united; 4th joint much shorter than 5th (ratio 33:12:18). Sumatra **anthreptes**
6. Abdomen black, apical margins of segments dark brown; basal portions of tergites 1-5 moderately densely clothed with short, sub-appressed, black pubescence, sparsely intermingled with short (on 4 and 5 rather long), erect, black and a few fulvous hairs, this dorsal pubescence not obscuring surface; tergites moreover with broad,

conspicuous, apical fasciae of dense ochraceous-orange pubescence; the band on 2 occupies about the apical two-fifths, but on the remaining tergites they cover considerably more of the exposed surface, being rather wider laterally than on mid-dorsum (distinctly so on 2) and not very sharply delimited anteriorly; tergite 6 and 7 clothed with black pubescence and with an apical fringe of brownish-black hairs. Black patches on each side of the middle on clypeus usually strongly divergent anteriorly, their apex far removed from anterior margin, each generally not wider than diameter of lateral portions of face. Dorsal pubescence of thorax moderately dense, not concealing surface, ochraceous-orange with numerous black hairs intermixed. Pubescence on outer face of posterior tibia entirely pale-coloured, on the inside and beneath black; pubescence on outer face of posterior basitarsus mainly black but entire surface with several fulvous hairs somewhat sparsely intermixed. Third antennal joint rather short, two times as long as its width at apex and a trace longer than joints 4 and 5 united; 4th joint somewhat shorter than 5th (ratio 33:12:18). Seventh abdominal tergite less deeply emarginate than in *cinnyris*, the apical teeth shorter. Java **cyrtandrae**

- 6'. Abdomen black, apical margins of segments rather paler, ochraceous-tawny, especially those of sternites; tergites 1-5 evenly and very densely clothed with short, appressed, xanthine-orange or mars-yellow pubescence, very sparsely intermingled with short, erect hairs of the same colour and on base of 4 and 5 with a few slightly longer, arcuate, black and orange hairs, this dorsal pubescence almost completely obscuring surface; tergite 6 and 7 clothed with deep black hairs, the apical fringes also black. Black patches on each side of the middle on clypeus distinctly larger, closely approximated along median line and more abruptly truncated apically, their apex approaching anterior margin, each decidedly wider than diameter of lateral portions of face. Dorsal pubescence of thorax short and dense, concealing more of the surface, xanthine-orange with numerous black hairs intermixed. Pubescence on outer face of posterior tibia mainly pale-coloured, except a narrow stripe of brownish-black hairs along exterior ventral carina, on the inside and beneath also black; pubescence on outer face of posterior basitarsus either entirely black, or with some fulvous hairs intermixed at extreme base only. Third antennal joint short, less than two times as long as its width at apex and about equal in length to joints 4 and 5 united; 4th joint much shorter than 5th (ratio 28:9:17). Seventh abdominal tergite deeply emarginate, the apical teeth longer than in *cyrtandrae*. Sumatra **cinnyris**

Females

1. Tergites 1-4 of abdomen mainly clothed with pale (fulvous or green) pubescence or with transverse fulvous pubescent fasciae along apical margins 2
- 1'. Tergites 1-5 of abdomen deep black, mainly clothed with very short, suberect black pubescence, without transverse fulvous pubescent fasciae along apical margins; tergite 1 with small lateral tufts of orange-rufous hair and some scattered hairs of same colour on dorsum; tergites 2, 3 and 4 with white hair-bands along apical margins, those on 2 and 3 very narrow and broadly interrupted, that on 4 wider than preceding ones and narrowly interrupted in the middle. Labrum and face yellow, marked with black similarly to *cyrtandrae*. Dorsal pubescence of thorax rich orange-rufous with few black hairs intermixed. Tegulae orange-rufous. Legs black; intermediate and posterior tibiae and basitarsi on the inside clothed with black pubescence; scopal hairs on outer face dense, throughout bright orange-rufous, but on distal half of basitarsus black, the boundary-line diagonal and well-marked. Posterior tibia broad, length: width = 12.5:4.8, posterior metatarsus 8.3:3.8. Scape of antenna black; third joint a little longer than joints 4-6 united.
Java *jacobi*
2. Abdomen above evenly clothed with fulvous pubescence (not green in certain lights), or alternately black- and fulvous-haired, with or without pale pubescent fasciae along apical margins. Scopal hairs on outer face of posterior tibia never partially black. Tegulae pale-coloured 3
- 2'. Abdomen above evenly clothed with short, appressed, rich biscay-green pubescence, with fulvous hairs sparsely intermingled: in dorsal view the abdominal pubescence has a fulvous tinge, viewed from behind it is rich emerald-green; tergite 5 with a dense apical fringe of golden-yellow hairs. Body black, head with pale face-marks reduced; labrum black with two large bluish-white spots, clypeus with a fine T-shaped spot bright yellow, and a small supra-clypeal spot of same colour; lateral portions of face all black. Long soft hair on lower part of temples snow-white. Dorsal pubescence of thorax olive-green and honey-yellow with numerous black hairs intermixed. Tegulae black. Legs mummy-brown, for the most part black-haired, anterior two pairs of femora with white hairs intermixed, coxae and trochanters with white pubescence; posterior tibia and basitarsus on the inside clothed with black or dark brown hairs, respectively; scopal hairs dense, on outer face of tibia black but on dorsal ridge bright orange, on basitarsus entirely black. Posterior tibia and

basitarsus broad, tibia 12.0:4.5, basitarsus 9.7:5.5. Antennae black; third joint fully as long as joints 4-6 united. Perak; Sumatra

..... **hanitschi**

3. Species of huge size, body-length 22-24 mm approx. Abdominal tergites black, with very short, sub-appressed black pubescence, tergites 1-4 moreover with sharply defined, appressed orange-buff, pubescent fasciae along apical margins, these bands becoming gradually broader posteriorly; pubescence on apical segments also pale-coloured. Face strongly protuberant, facial depth greater than diameter of eye; labrum and face yellow, marked with black much as in *feronia*, but clypeal spots larger and the black on lateral portions of face more extensive. Long soft hair on lower part of temples pale yellowish. Dorsal pubescence of thorax not very dense, ochraceous-buff with numerous black hairs intermixed. Legs cinnamon-rufous, pubescence sparse, throughout ochraceous-orangish, scopal hairs not concealing surface. Posterior tibia and basitarsus slender, tibia 18.0:4.8, basitarsus 12.1:3.9. Antennae very short, not attaining tegulae, third joint somewhat longer than joints 4-6 united. Sumatra

..... **elephas**

- 3'. Species of smaller size, body not exceeding 17 mm in length 4
4. Labrum and face reddish- to dark blackish-brown; clypeus without any indication of an impunctate median longitudinal carina, unmarked except a small, triangular yellow spot placed in middle along anterior border. Abdomen black, tergite 1 dirty brown, apical margins of tergites 2-5 brown, apical margins of sternites red-brown; pubescence rather long, sub-erect, not very dense; hair on tergite 1 sparse, mainly black, on each side along margin tufts of ochraceous-buff pubescence; tergite 2 on disk mainly black-haired, 2-4 each with rather broad fasciae of appressed yellow-ocher pubescence along distal margin, 5 moreover with a dense apical fringe of orange-rufous hair. Dorsal pubescence on head and thorax greyish- to ochraceous-buff with black hairs intermixed. Legs auburn, pubescence mainly brown, posterior tibia and basitarsus on the inside black-haired, scopal hairs on outer face orange-rufous, those on basitarsus long, shading to dark brown distally. Third antennal joint longer than joints 4-6 united. Sumatra **bouwmani**
- 4'. Labrum almost entirely yellow, face bright yellow, clypeus with large black spots. Pubescence of abdomen short. Dorsal pubescence of thorax ochraceous-orange to rich orange-rufous, more or less intermingled with black hairs 5
5. Legs decidedly pale-coloured, femora and tibiae either ochraceous-tawny or salmon-orange to orange-rufous, femora and basitarsi sometimes a little obscured. Lateral portions of face, almost as far

upwards as level of fronto-clypeal suture, yellow, with a fine orbital black line. Clypeus with very distinct, impunctate, median longitudinal carina. Labrum various shades of ochraceous-buff, without deep black basal stripe, the distal margin and basal tubercles never brownish-black or black. Long soft hair on lower part of temples with distinct yellowish hue. Scape of antennae and flagellar joints tawny or rufous anteriorly. Basal half of mesoscutellum with a distinct median longitudinal carina. Scopal hairs on outer side of posterior legs not entirely obscuring surface in dorsal view 6

- 5'. Legs black or very dark brown, femora and tibiae at most chestnut-coloured. Hair on clypeus brownish-black or black. Lateral portions of face mainly black, but each with a yellow stripe, tapering to a point ventrally, along lower two-thirds of clypeal suture. Labrum bright-yellow or whitish, with a sharply defined, deep black basal stripe, widening on each side so as to include the basal tubercles (these occasionally brown), and with the apical margin at least narrowly bordered with black. Long soft hair on lower part of temples snow-white. Scape of antennae black. Mesoscutellum with incomplete median longitudinal carina very weak and poorly developed. Scopal hairs on outer face of posterior legs denser, obscuring surface in dorsal view 7
6. Disk of abdominal tergites 2 and 3 with very short, sub-appressed, black pubescence, sparsely intermingled with short, erect, fulvous hairs; tergites otherwise uniformly clothed with short, appressed fulvous pubescence that becomes gradually more dense and conspicuous laterally and towards distal margin of segments so as to form densely pubescent apical fasciae, which are ill-limited anteriorly. Tegument of abdominal tergites dark brownish-black, but the apical margins, especially of tergites 2-5, tawny, showing through the pubescence. Hair on clypeus throughout golden-brown. Dorsal pubescence of thorax bright orange-rufous in fresh examples, sparsely intermingled with black hairs. Legs mainly salmon-orange to orange-rufous; coxae, trochanters and posterior femora sometimes rather dusky but distinctly lighter than in ♂, the basitarsi dark brown; pubescence pale, on posterior tibia throughout ochraceous-orange (except a sparse fringe of black hairs along innermost ventral ridge), scopal hairs on outer face of basitarsus ochraceous-orange, appressed pubescence on the inside of basitarsus russet. Posterior tibia elongate, 14.5:4.2, basitarsus 9.2:3.8. Third antennal point very little shorter than joints 4-6 united. Java **feronia**
- 6'. Disk of abdominal tergites 2 and 3 without any black hairs, tergites 1-5 evenly and densely clothed with short, sub-appressed, ochraceous-tawny to buckthorn-brown pubescence, the hairs more numerous and

a little longer towards apical margin but not forming transverse pubescence fasciae. Tegument of abdominal tergites brownish-black, almost black, the apical margins very broadly tawny, thus accentuating the pubescence. Hair on clypeus mainly black. Dorsal pubescence of thorax mainly ochraceous-buff with numerous black hairs intermixed. Legs dirty ochraceous-tawny, coxae and femora only slightly obscured, the basitarsi mummy-brown; pubescence pale, on posterior legs very similar to *feronia*, but scopal hairs on outer face of tibia shorter and a little more dense, almost concealing surface in dorsal view. Posterior tibia elongate, shaped much as in preceding species, 14.0:4.0, basitarsus 9.8:4.0. Third antennal joint a little longer than joints 4-6 united. Sumatra **anthreptes**

7. Abdomen black, apical margins of segments dark brown; tergites 1-4 moderately densely clothed with short, sub-appressed black pubescence, sparsely intermingled with short, erect, fulvous and black hairs, this dorsal pubescence not obscuring surface; tergites moreover with rather broad, conspicuous, apical fasciae of dense ochraceous-orange pubescence, these bands rather sharply delimited anteriorly; dorsum of 5 clothed with tawny hairs and with a black apical fringe, the sides and lateral margins of 5 fringed with ochraceous-orange hair. Dorsal pubescence of thorax moderately dense, not concealing surface, ochraceous-orange with numerous black hairs intermixed. Clypeus with indistinct, very low, impunctate median longitudinal carina. Legs black or very dark brown (mars brown); pubescence pale, moderately dense, that on outer face of intermediate tibiae not concealing surface; posterior tibia and basitarsus on the inside black-haired, scopal hairs on outer face of tibia and basal two-thirds of basitarsus ochraceous-orange, those on distal portion and lower margin of basitarsus black, the boundary-line somewhat oblique but not very well marked-off. Posterior tibia 12.0:4.3, basitarsus 8.5:3.7. Third antennal joint a little longer than joints 4-6 united (45:43). Java **cyrtandrae**

- 7'. Abdomen black, apical margins of segments pale-coloured: tergites 1-4 evenly and very densely clothed with short, appressed, mars-yellow pubescence, very sparsely intermingled on 1-3 with short, erect hairs of the same colour and on 4 with a few slightly longer, arcuate black and ochraceous bristles, this dorsal pubescence almost completely obscuring surface; dorsum of tergite 5 clothed with deep black hairs, the apical fringe also black, sides and lateral margins fringed with ochraceous hair. Dorsal pubescence of thorax dense, concealing most of the surface, coloured similarly to *cyrtandrae*. Clypeus with distinct, shining, impunctate median longitudinal carina. Legs chestnut-coloured, posterior tibia and basitarsus slightly darker,

pubescence pale, more dense than in *cyrtandrae*, that on outer face of intermediate tibia obscuring surface; posterior tibia and basitarsus black-haired on the inside, scopal hairs on outer face of tibia and basal half of basitarsus more dense, ochraceous-orange, those on distal half and lower margin of basitarsus black, the boundary-line diagonal and sharply delimited. Posterior tibia 12.0:4.2, basitarsus 8.4:4.1. Third antennal joint a little longer than joints 4-6 united (42:38). Sumatra **cinnyris**

***Anthophora bouwmani*, sp. n.**

Material studied. — Sumatra: 1 ♀ (holotype), South Sumatra, Lampoeng residency, summit of Mt. Tanggamoos, 2100 m, 1.i.1935, M. A. LIEFTINCK.

♀. — Labrum very densely, coarsely punctured; the distal margin and the top of basal tubercles smooth; puncturation of clypeus and lateral portions of face also dense but somewhat irregular and arranged in more or less confluent, longitudinal rows, especially on middle. Clypeus with a small, more or less triangular, median apical area rather smooth, but its surface microscopically reticulate; no median carina. Frons and vertex dull, densely coarsely punctured; frons with a short, impunctate, median longitudinal carina, vertex between ocelli and eye rather shiny. Mandibles smooth, with a few scattered punctures. Malar space very narrow. Antennae short, attaining tegulae.

Thorax with the mesonotum scutellum very densely closely punctured, surface slightly shining; scutellum with very distinct, impunctate, median longitudinal carina; thoracic sides moderately shining, evenly very finely punctured. Tegulae shiny, with scattered very fine punctures.

Legs and wings without peculiarities.

Abdomen strongly convex above, widest across segment 2, thence gradually tapered; dorsal surface rather shining, tergites 3-5 densely superficially punctured, the pale apical margins smooth; sternite 1-2 smooth and shining, with small scattered punctures, surface of remaining sternites dull, finely granular and with scattered punctures. Pygidial plate tongue-shaped, surface distinctly convex, lateral margins not definitely raised, surface dull finely granular, lacking microscopical scale-like sculpture, apex very slightly produced.

Head black. Mandibles chestnut-coloured, bases and tips black. Labrum chestnut-brown, clypeus dark blackish-brown, the very small triangular area along apical margin of clypeus dirty yellowish fading to reddish dorsally. Antennae brownish-black, the flagellar joints dark reddish-brown anteriorly.

Thorax black. Wings with distinct yellowish tinge; tegulae ochraceous-tawny.

Legs auburn or mars-brown, tarsi russet; tibial spurs mummy-brown.

Abdomen brownish-black, the apical half of the horizontal part of tergite 1 russet, and apical margins of tergites 2-4 dirty ochraceous; sternites raw umber, the apical margins of 1-5 conspicuously and broadly amber-brown. Pygidial plate dark brown.

Pubescence moderately dense but rather long. Hair of face below antennae sparse; labrum almost nude basally, distal half with long, sub-erect, warm buff hairs; clypeus on middle with only a few erect blackish hairs, the lateral portions of face with abundant long, erect, arcuate, brownish black hairs and with a rather dense lateral covering of much shorter, appressed, light buff pubescence bordering the eye-margin and lower margin of clypeus; frons and vertex above with tufts of long, feathered, light ochraceous-buff pubescence and with still longer erect black hairs sparsely intermixed; long soft pubescence on temples pale yellowish-white. Pubescence on dorsum of thorax rather dense, strongly feathered, ochraceous-buff with numerous black hairs intermixed, but on each side of the scutellum, behind the tegulae, the hair is more tufted and has a distinct ochraceous-orange tinge, thoracic sides with ochraceous-buff pubescence. Hair of legs sparse, mainly ochraceous-buff, on all coxae and trochanters rather long and plumose ventrally, femora sparsely fringed with long dark brown hairs; hair on inner face of anterior two pairs of tibiae and metatarsi dark, on outer faces ferruginous or tawny, on tarsal joints ochraceous-orange.

Posterior femora with short blackish hairs, tibia and basitarsus on the inside black-haired, scopal hairs on outer face of tibia and basal half of basitarsus long and dense, concealing surface, orange-rufous (as is a narrow fringe of hairs on the inside along upper margin of tibia), hair on distal half of basitarsus sparse, not obscuring surface and turning to chestnut colour; penicillus glistening orange-chrome in certain lights.

First abdominal tergite with longish, erect, dark and pale hairs on disk and with a rather dense apical fascia of sub-appressed, ochraceous-buff pubescence, narrowly interrupted on mid-dorsum. Tergites 2 and 3 with moderately dense, sub-erect, black pubescence, intermingled with yellow-ocher and with apical hair-bands of a purely yellow-ocher colour; the pubescence becomes successively longer and more dense on following segments, on 3 the mixture of black hairs lessens and on 4-5 there are no more black hairs intermixed; pubescence on 5 dense, the apical fringe orange-chrome. Sternites almost hairless, 3-5 each with an apical fringe of erect ochraceous-orange hairs; apex of 6th sternite fringed with orange-rufous bristles.

Length of body 14.8, width across 2nd abdominal segment 6.0, anterior wing 11.4 mm.

This species is chiefly characterized by its sombre colours, the head being without any clear face-marks, which are peculiar to all other Malaysian species of the genus. It is also distinguished from other *Anthophora* by the much longer dorsal pubescence of the abdomen. It was found flying on the very summit of Mt. Tanggamoës and, with *Bombus senex*, was the only bee captured there.

Named in honour of the late B. E. BOUWMAN, eminent Dutch hymenopterist, who died in 1935.

***Anthophora hanitschi* MEADE-WALDO. (fig. 32-37).**

1914. MEADE-WALDO, Ann. Mag. Nat. Hist. (8) 13, p. 45 (key), 52.— ♀ Perak.

1929. DOVER, Bull. Raffles Mus. 2, p. 56.— Perak and Selangor (no descr.).

Material studied. — Sumatra: 1♀, 4♂, South Sumatra, Lampoeng residency, Giesting, foot of Mt. Tanggamoës, 600 m, 21 & 27-29.iii.1940, M. A. LIEFTINCK, all on flowers of *Lantana camara*. Allotype ♀: Mt. Tanggamoës, 27-29.iii.1940, M. A. LIEFTINCK.

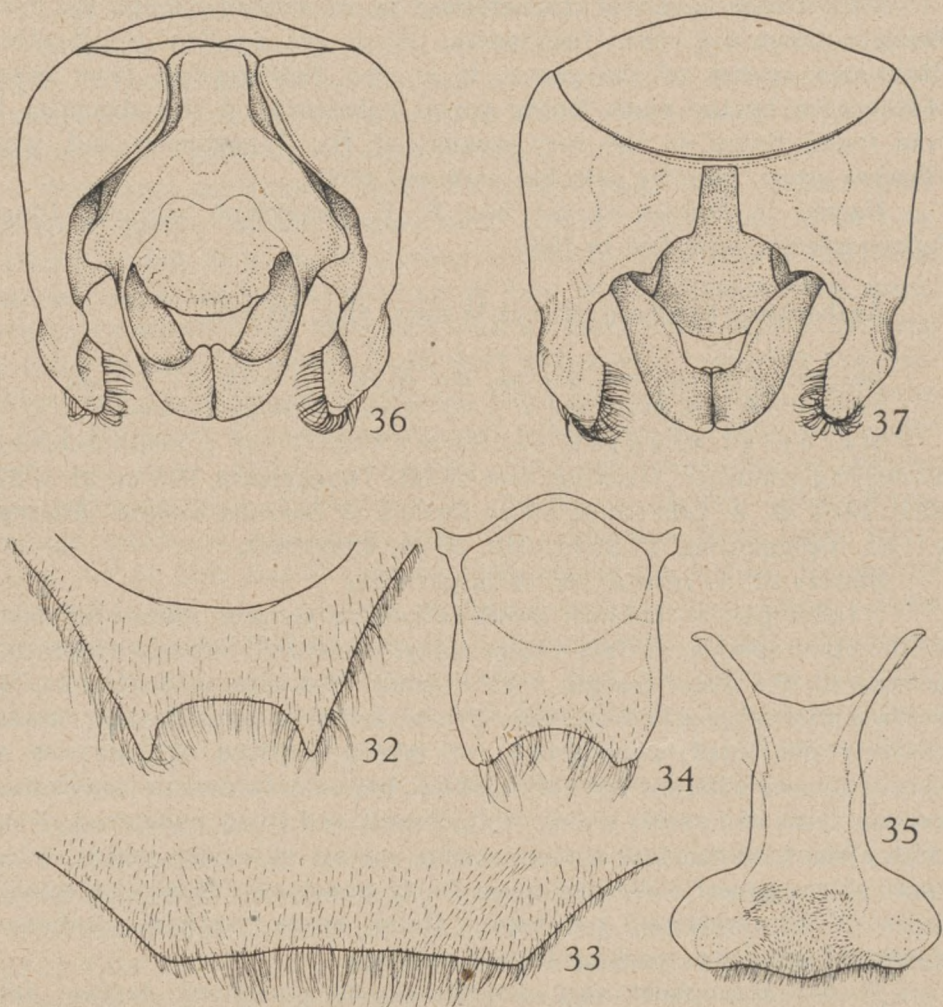
Stature of *A. zonata*, but of larger size.

♂ (allotype). — Labrum about as long as clypeus, shaped similarly to the other species; surface rather shiny, moderately densely and deeply punctured, the distal margin with a small, crescentic emargination, its surface microscopically reticulate; clypeus and area frontalis dull, densely coarsely punctured, puncturation of lateral portions of face not so dense; clypeus with low but very distinct, impunctate median longitudinal carina; frons and vertex mainly dull, densely and finely punctured; frons with a short, impunctate median carina, surface of ocellar region rather more shiny, superficially and more finely punctured. Mandibles smooth with a few scattered punctures. Malar space vestigial. Antennae comparatively long, reaching beyond tegulae.

Thorax throughout very densely closely punctured, surface dull, mostly hidden under the dense hair; scutellum without median carina; tegulae rather dull, microscopically punctured.

Legs and wings without peculiarities; posterior tibia and basitarsus broad, strongly compressed.

Abdomen of the usual shape, widest across segment 2; dorsal surface dull, densely finely punctured, sculpture barely visible under the dense pubescence, apical margins shining, microscopically reticulate; sternites 1-3 highly polished, with few scattered punctures, the broad apical margins finely longitudinally striate, surface of remaining sternites moderately shining, densely very finely punctured, along apical margins a narrow seam with microscopically striate sculpture. Seventh tergite shaped as shown in fig. 32. Apical margin of 5th sternite shallowly and very broadly emarginate, 6th sternite broadly truncate, the apical margin very slightly concave with its lateral angles obtuse-angulate (fig. 33).



Anthophora hanitschi. Meade-Waldo. Lampongs, S. Sumatra.

Seventh and 8th sternal plates shaped as in fig. 35 and 34, respectively. Genital apparatus broad, somewhat squarish in outline, brown in colour. Median lobe of aedeagus (spatha) small, membranous, not concealing sagittae, in the form of a roundish connectiva with slightly convex dorsal surface and broadly rounded distal margin. Valva externa and volsella apparently grown together, shaped as in fig. 36 and 37, the apices incurvate and obliquely truncated, fringed with long arcuate bristles; sagittae about equal in length to the stipites, nude, somewhat twisted, convergent, their distal portion strongly incurved, apices truncated, closely approximated in the median line.

Head black. Labrum pale bluish milky-white with a thick, rather saddle-shaped, basal stripe that includes also the tubercles, and the

anterior border more narrowly, black. Mandibles bright lemon-yellow exteriorly, margins black, the distal half reddish-black. Clypeus with a sharply defined, slender T-shaped mark, bright lemon-yellow in colour, the stem of the T tapering to a point basally and nearly touching a small triangular spot of the same colour, placed along fronto-clypeal suture, on the area frontalis. Lateral portions of face partly also lemon-yellow, the area thus coloured in the form of an isosceles triangle with the long side bordering the orbits, which are finely black. Antennae black, scape lemon-yellow anteriorly, flagellar joints with anterior faces dark reddish-brown. Tegument of thorax black.

Wings with the venation dark brown, almost black, membrane definitely smoky-grey with slight yellowish intermingling. Tegulae brownish-black.

Legs black, femora very dark brown, the posterior two pairs on the inside dark cinnamon-brown; anterior apical tarsal joints and all claws (except apically) chestnut-coloured; tibial spurs black.

Abdomen apparently very dark brownish-black above, the apical margins hazel or mars yellow but not strongly showing through the pubescence, except on the sclerites beneath; sternites cinnamon-brown, 1 and 2 ochraceous-tawny in middle, apical margins rather more ochraceous-buff.

Pubescence of labrum recumbent, rather short and not very dense, all white, inclusive of a long apical fringe, outer margin of mandibles fringed with very long, arcuate, white hairs. Clypeus on middle with long, arcuate black hairs and much shorter white hairs somewhat sparsely intermixed; moreover with numerous short, sub-appressed, white hairs on either side between labrum and margin of compound eyes. Erect hair of frons, vertex and on upper half of lateral portions of face slightly feathered, rather tufty and of different sizes; the longest hairs are black, small tufts of shorter ones immediately in front and around the antennae are pale glaucous, turquoise-green or emerald-green, whilst the vertex is mainly black-haired except along occipital margin, where it is again distinctly blue-green in certain lights. Long, soft, feathered pubescence on underside of head and on the temples, snow-white.

Dorsal pubescence of thorax dense, though rather short and irregular, hiding most of the surface, hairs behind tegulae, on postscutellum and propodeum longer; lateral pubescence under the wings pale yellowish intermingled with black, lower down pure white.

Pubescence of anterior legs, especially on coxae and trochanters, long and entirely white, remaining parts on the inside black-haired, on outer faces mainly white with black hairs sparsely intermixed; coxae and trochanters of middle and hind legs white-haired, hairs on outer face of middle tibia and along upper half of basitarsus, yellowish (on

basitarsus in one specimen almost wholly black), otherwise black; pubescence of posterior legs similar to female but orange hairs on outer face of tibiae not so bright, but covering the upper three-fourths of the surface instead of being restricted to the dorsal ridge and the upper one-fourth of the outer surface. Dorsal pubescence of abdomen very uniform and dense, only the first tergite basally with numerous, longer, sub-erect, black hairs intermixed; admixture of long fulvous hairs increasingly more evident on the two or three apical tergites and in 2 out of 4 specimens partly black instead of fulvous. Venter with fine, short and very sparse, appressed, light hair, except before apical margins of sternites where it is longer and erect.

♀. — This sex has been described by MEADE-WALDO; the following additional notes complete this description.

Resembling the ♂ in most respects but differing as follows. Black markings on labrum, face and mandibles much more extensive; labrum black except a pair of large, somewhat squarish, milky-white spots, each of them finely bordered with black laterally and placed on either side of the median black bar, which is broadly connected with a thick basal stripe of about the same width. Mandibles chestnut-brown, outer faces with a triangular, bright greenish-yellow fleck, occupying about the basal third of each. Clypeus with the yellow T-spot very slender, the stem of the T not reaching fronto-clypeal suture; no lateral yellow face-marks. Recumbent hairs on labrum white, but on middle there are several black hairs intermixed. Face sparsely clothed with long, erect black hairs intermingled with more abundant (but much shorter) recumbent hairs of a delicate pale blue tint, giving it a superficial bluish hue; this light hair still more conspicuous, rather fleecy, on each side upon lower edges of clypeus and along inner orbits. Frons with a conspicuous transverse fringe of very long black hairs, placed half-way between ocelli and antennae and with tufts of short, bluish-white pubescence roundabout and between the antennae. Antennae attaining tegulae, coloured black, the distal flagellar joints dark brown anteriorly.

Thorax, legs and wings similar to male and as described in the key. Hair on anterior two pairs of tibiae and basitarsi on the outside intermingled with numerous short, sub-appressed, bluish-white hairs which give these joints a distinct bluish-grey hue; remaining tarsal joints with rather conspicuous rufous hair. Posterior tibia and basitarsus very broad, with conspicuous long and dense pubescence; tibial hairs obscuring surface in dorsal view, colour deep black, but on upper one-fourth of outer face and on dorsal ridge bright orange, the apical tuft orange-yellow. Penicillus glistening brownish-black. Spurs black.

Abdomen coloured as in male, lateral margins of tergites 4-6 as well as those of sclerites conspicuously fringed with long, golden-yellow hairs;

otherwise as described in the key. Sternites dark brown, the glassy apical margins yellow-ocher; pubescence as in male. Pygidial plate not studied.

♀ Length 15.8, greatest width of abdomen 6.1, anterior wing 11.5; ♂ length 14.0 (allotype), 13.9-14.5 (paratypes); greatest width of abdomen 5.0 (allotype), 5.2-5.8 (paratypes); anterior wing 9.5 (allotype), 9.7-10.3 mm (paratypes). Tongue 11 mm approx. (♂).

The female from Sumatra, described above, agrees so closely with MEADE-WALDO's description of the type from Perak, that it may be assumed with reasonable certainty that the two insects are conspecific.

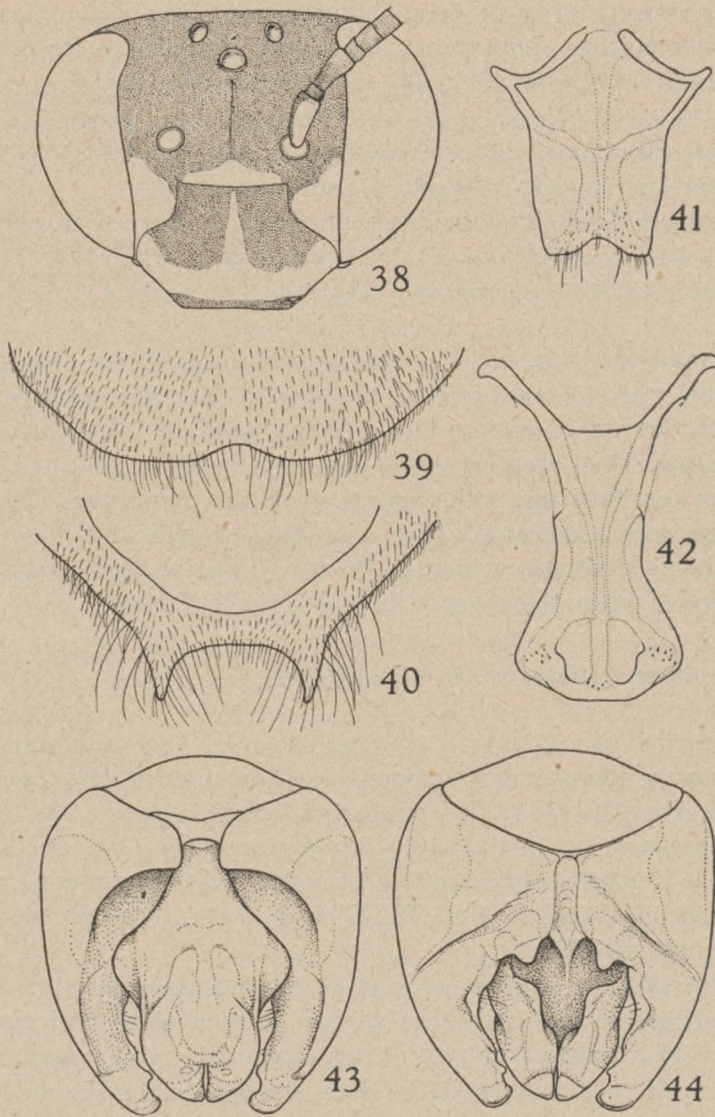
This handsome species is probably very local in its distribution as it was found only in one place at the foot of Mt. Tanggamoos, visiting the highest flowers of one or two isolated *Lantana* bushes, at the edge of dense forest. They are very swift and wary bees, singing in a different key as they searched the pink flowers, than the numerous '*zonata*', with which they were associated. They like the hot sun and when the sky clouds over, the slightest coolness in the air will drive them away, whereas the bluebanded bees, then, are still busy on the flowers.

***Anthophora elephas*, sp. n. (fig. 45-51).**

Material studied. — Sumatra: 1 ♂ (holotype), 4 ♀, South Sumatra, Lampoeng residency, Giesting, foot of Mt. Tanggamoos, 600 m, ult. xii.1939 (1 ♂, 2 ♀), 21 & 27-29.iii.1940 2 ♀, on flowers of *Phacomeria solaris* (2 ♀, iii.1940), *Lantana camara* (1 ♂, xii.1939), and among dense vegetation of *Imperata arundinacea* (alang-alang) (2 ♀, xii.1939), all in one locality, Mrs. M. & M. A. LIEFTINCK. Holotype ♂ and allotype ♀: ult. xii.1939.

♂ (holotype). — Labrum as long as clypeus, shaped as usual but its anterior margin almost straight; surface rather shiny, microscopically wrinkled, with a number of very large, scattered, rather deep punctures which are most conspicuous on the disk, smaller on the lateral faces and absent from the longitudinal bends on either side of the disk. Face comparatively narrow and strongly protuberant. Clypeus above dull, surface finely chagreened, evenly very coarsely punctured, with a complete, low, smooth median carina, the lateral prolongations smooth and shiny with a few scattered punctures. Mandibles on the outside and lateral portions of face smooth and polished, upper half of the latter with some scattered fine punctures. Malar space narrow. Frons without median carina, sculpture similar to clypeus; vertex rather shiny, puncturation superficial, irregular, fine. Antennae short, reaching as far as middle of tegulae.

Thorax on mesonotum and on the pleurae finely and very densely



Anthophora jacobii sp. n. Djampang, W. Java.

punctured, surface slightly shining, only partly hidden under the pubescence; scutellum less densely punctured with small smooth areas on either side of the median longitudinal carina which is only weakly developed; tegulae rather shiny, surface covered with extremely fine, superficial punctures.

Legs and wings without peculiarities, but posterior legs very slender, tibia and basitarsus comparatively narrow and but little compressed.

Abdomen of the usual shape but decidedly more flattened above than in allied species, widest across apex of segm. 2; dorsal surface dull,

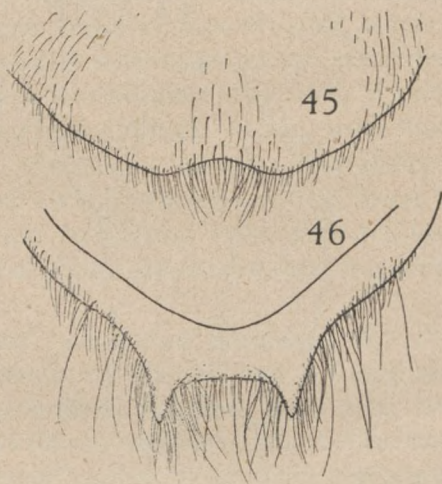
throughout evenly and extremely finely punctured, also on the apical margins of tergites 1-4, those of apical segments (narrowly) without punctures; sternites 1-4 highly polished, with a few scattered punctures on disk, the broad apical margin and a narrow lateral area, and most of the sclerites, moderately densely but very finely punctured; surface of 5th and 6th sternites also smooth and shiny, but with the puncturation somewhat denser. Seventh tergite shaped as shown in fig. 46, the apical teeth placed not far apart. Apical margin of 5th sternite almost straight, the 6th a little produced apically, distinctly though shallowly emarginate (fig. 45). Seventh and 8th sternal plates shaped as in fig. 49 and 48, respectively. Genital apparatus as a whole resembling more closely that of *hanitschi* than that of the other brown-haired species, especially in that the membranous median lobe of the aedeagus is only small, with a free distal margin, and covering only part of the sagittae; for details see figs. 50 and 51.

Head black. Labrum primuline yellow, the anterior border in middle very finely seamed with ochraceous, and the basal tubercles diffusely pale brownish; labro-clypeal suture chestnut-coloured. Mandibles on the outside lemon-yellow, distal portion, from near base of inner subapical tooth, chestnut-brown to almost black apically; malar space shining brownish-black.

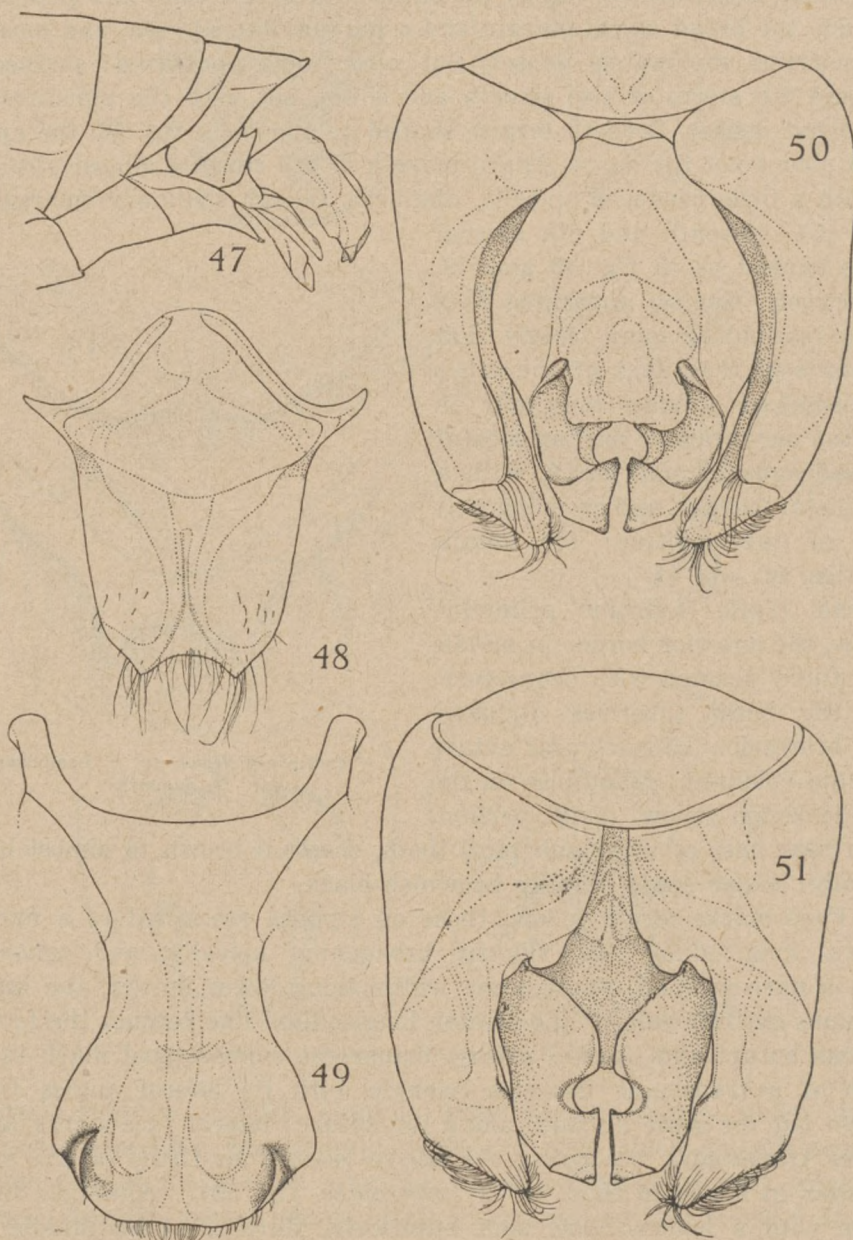
Face marks lemon-yellow, those on clypeus restricted to a narrow central longitudinal line, slightly broadening apically, and connected with a narrow band of the same width along lower border, the lateral divisions entirely yellow; the median longitudinal line reaches the fronto-clypeal suture and touches a tiny, transverse supraclypeal mark in the form of a transverse isosceles triangle with its lateral angles finely drawn out for some distance along the suture; lateral face-marks large, rather trapezoidal, occupying the entire lower four-fifths of the space (similar in shape to those of ♂ *anthreptes*, fig. 59). Antennae black, scape with a lemon-yellow spot anteriorly, third joint on middle and flagellar joints 5-13 dark rufous beneath. Tegument of thorax black.

Wings with the venation brown (costal veins very dark), membrane dirty flavescent. Tegulae tawny.

Legs throughout cinnamon-brown, last tarsal joint and basal half of claws tawny; tibial spurs dark brown.



Anthophora elephas sp. n. Lampongs,
S. Sumatra,



Anthophora elephas, sp. n. Lampongs, S. Sumatra.

Abdomen brownish-black, the apical margins narrowly ochraceous-tawny, not showing through the pubescence except on the sclerites of the basal three segments beneath; sternites prout's brown, 1-5 with the apical margins broadly, ochraceous-tawny, fading to yellow-ocher apicad, 6th sternite almost wholly ochraceous-tawny.

Pubescence scanty. Hair on labrum very short and sparse, sub-erect, yellowish, apical fringe and a few erect hairs laterally somewhat longer, ochraceous-buff. Exterior margin of mandibles with a sparse fringe of very long, light buff hairs. Clypeus above sparsely clothed with short erect black hairs, side portions and lower part of lateral face-marks almost nude, the latter with some short, arcuate hairs directed anterad. Hair on frons, especially between antennae, somewhat longer, consisting of a number of long, straight black hairs intermingled with tufts of much shorter, ochraceous-buff pubescence around antennal bases; erect black and short light hairs on vertex few in number, except along occipital margin which is more densely fringed with ochraceous-tawny. Scape of antennae with rather long blackish and ochraceous hair. Soft feathery pubescence on underside of head rather long, ochraceous-buff becoming light buff towards the mouth.

Dorsal pubescence of thorax short, somewhat irregular, not very dense, the sculpture of the surface remaining visible; hair on each side of scutellum and on propodeum longer and more dense, concealing most of the surface, a small tuft of hair immediately behind tegulae ochraceous-orange without intermingling of black hairs; long ochraceous-buff pubescence on either side of propodeum also more uniform and without admixture of black hairs; lateral pubescence moderately long and dense, pale ochraceous-orange, intermingled under the wings with black hairs.

Pubescence of legs short and scanty, only the coxae in front with long soft hairs; femora on the inside almost nude, with extremely fine appressed tomentum; hair on the narrow under surfaces of middle and hind tibiae blackish, otherwise light brown; short velvety pubescence on the inside of posterior basitarsus and the next two joints rather more cinnamon-rufous, the fringe along ventral carina of basitarsus blackish-brown.

Black dorsal pubescence of abdomen as described in the key, very short but not entirely concealing surface, the apical fasciae very dense and conspicuous, hiding the tegument; 1st tergite with a conspicuous lateral tuft of ochraceous-buff hairs and basal on dorsum with arcuate, semi-erect chestnut-brown and ochraceous hairs somewhat sparsely intermixed, the apical fascia about three times as wide laterally as it is on mid-dorsum; the pubescent fascia on the 2nd tergite occupies the apical one-third, that on 3rd about the apical half and that on 4th all but a narrow basal stripe of the exposed surface, whilst the tergites 4-6 are

entirely covered with appressed orange-buff pubescence. Hair on 7th tergite glistening light buff and with apical fringes of ochraceous-tawny. Venter with sparse, very fine appressed light tomentum, denser laterally, a sparse fringe of sub-erect hairs before margin, and with narrow, appressed, apical hair-bands.

♀ — Resembles the ♂ in most respects, but is a more robust insect. Differs as follows.

Light face-marks, including the labrum, lemon-chrome, slightly more reduced. Hair of labrum glistening antimony-yellow; surface of basal part of the galeae sparsely, coarsely punctured and clothed with a number of conspicuous, semi-erect, golden-orange hairs. Clypeus with a sharply defined median carina which fades away towards anterior border; short arcuate hairs on disk denser, ferruginous, shading to black laterally, the side-portions of clypeus and lateral face-marks almost naked; anterior margin of clypeus finely bordered with brown, lower edges of the lateral prolongations also slightly dusky. Transverse part of the yellow mark on middle of clypeus hardly wider than the obscured anterior margin, the stem of the T also a little narrower and leaving off shortly before fronto-clypeal suture; triangular spot on area frontalis small, the basal angles only slightly drawn out laterad; lateral yellow face-marks reduced to a drop-shaped spot, tapering to a point beneath, placed along the clypeal suture, the inner orbits thus broadly bordered with black. Frons with a squarish, highly polished area just in front of the antennae. Antennae short and thick, not attaining tegulae, black, the seven apical joints sanford's brown anteriorly; scape black, above clothed with long, conspicuous, erect, glistening orange-rufous hairs, beneath fringed with shorter, buff-coloured hairs. Hair on vertex very sparse, the surface plainly visible.

Thorax as in ♂, scutellum with a low, fine, impunctate median longitudinal carina; dorsal pubescence still shorter and even less dense than in ♂, colour distinctly darker, caused by a more abundant admixture of black hairs, tegument plainly visible through the pubescence; small patch of plumose hairs behind tegulae definitely ochraceous-orange, long pubescence on either side of propodeum snuff-brown.

Legs less dusky than in the ♂, cinnamon-rufous to amber brown; pubescence ochraceous-orange to raw sienna, scopal hairs slightly more palely tinted; hair on under surfaces of middle and hind tibiae not or only very little obscured; short velvety pubescence on the inside of middle and hind basitarsi mars yellow, becoming orange-rufous along upper and lower margins, scopal hairs moderately long but not dense, not nearly concealing surface; penicillus glistening bright rufous.

Abdomen broad and flat, oval, widest across posterior border of 2nd segment, apical segments rather long, tapered. Sculpture of dorsal

surface similar to ♂. Pygidial plate tongue-shaped, the lateral margins very slightly upcurved; surface of disk very slightly convex, in perfectly clean specimens (the type only!) dark brown, glistening, microscopically scaled, the scale-like sculpture on basal part more or less arranged in transverse rows which are convex posteriorly, sculpture of distal part irregular. Sternites less strongly polished, surface microscopically reticulate, puncturation of 1-3 not dense, most conspicuous on middle of disk, laterally very fine and dense, the apical margins on middle without punctures; sternites 4-5 more densely punctured, the punctures of two sizes, growing larger towards the middle and apically. Sixth sternite tapering, apex rounded with a tuft of strong golden-yellow bristles.

Pubescence of abdomen exactly as in the ♂, the transverse apical fasciae very conspicuous, light orange-yellow, hiding the surface completely; 1st tergite as in ♂, fascia on the 2nd tergite of even width throughout and occupying its apical third, on the 3rd tergite it is a little broader, widest on middle, occupying roughly its apical half, and on the 4th it occupies all of the exposed surface except a narrow basal stripe, somewhat dilated on each side of the middle, whilst the 5th tergite is densely clothed with sub-erect light hairs, the dense apical fringe having a glistening orange tint; hair on 6th tergite also orangish laterally. Sternites coloured similarly to the male, but the pale apical margins narrower, apical half of 6th sternite densely clothed with sub-appressed, orange-rufous hair.

♂. Length 19.5, greatest width of abdomen 6.0, anterior wing 11.6 mm (holotype). ♀ length 21.5, greatest width of abdomen 7.2, anterior wing 13.6 mm (allotype), 21.3-25.0, 7.0-7.4, 13.1-13.7 (parallotypes). Tongue 18 mm (♀ allotype). Body-length, from tip of glossa to apex of abdomen, measuring 42 mm (♀ allotype).

This enormous, very robust species is probably the biggest of all known Malaysian *Anthophorae*. Apart from its huge size it is easily distinguished from other brown-banded species by the scanty pubescence of the thorax and legs, and by the sharply pronounced light pubescent fasciae of the abdomen.

The male was captured over the pink flowers of a *Lantana* shrub and two females were beaten up early in the morning from their probable „sleeping-places”¹⁾ among tall grass not far off. Three months later two other females were secured in exactly the same spot whilst visiting

1) RAYMENT ("A Cluster of Bees", Sydney 1935, p. 382, 619, fig. 97), describes the way in which Australian blue-banded *Anthophora* and the larger *Asaropoda* males as well as females, will line themselves on a grassstem for "sleep". Various species of *Anthophora* and *Asaropoda* may assemble along a single stalk, holding on with their mandibles. See also RAU & RAU, "The Sleep of Insects; an ecological study" (*Ann. Ent. Soc. Amer.* 9, 1916, p. 227-274); and RAU, "Additional observations on the Sleep of Insects" (*Ibid.* 31, 1938, p. 540-556).

the radiant scarlet ground flowers of *Phaeomeria solaris*, of the Ginger family, which thrive among the undergrowth in a damp place beside the path. The slow, ponderous flight of the big females was decidedly striking.

Anthophora jacobii, sp. n. (fig. 38-44).

Material studied. — West Java: 1 ♂, Buitenzorg residency, Mt. Salak, northern slope, Waroengloa, 700 m, 17.xii.1939, and 3 ♂, Mt. Salak, eastern slope, Tjiboerajoet Est., near Tjigombong, 700 m, 10.xi & 1.xii.1940, on *Donax caniniformis*, all M. A. LIEFTINCK; 1 ♂, Mt. Salak, 24.i.1937, and 1 ♂ Mt. Panggerango, northern slope, Tapos, 800 m, 1-16.viii.1936, all in coll. J. VAN DER VECHT; 2 ♂, 1 ♀, Djasinga, 100 m, 1.vi.1936, 26.xi.1939 & 25.xii.1940, ♂ on *Globba marantina*; 13 ♂, 1 ♀, Djampang Tengah, Bodjonglopong, 600-650 m, 2.v.1940, 1.i.1941 & 16.ii.1941, on *Stachytarpheta jamaicensis*, *Coleus galeatus*, *Globba marantina*, and *Costus speciosus*, all Mrs. M. & M. A. LIEFTINCK; 1 ♂ 4 ♀, Djampang Tengah, Mt. Tjimerang, 6-700 m, xii.1931, M. E. WALSH ded., Mt. Malang, ca 800 m ?, i.1940, native coll., and 2 ♀, Djampang Koelon, Tjiajoenan, alt. ?, iv.1940, native coll., M. E. WALSH ded.; 3 ♂, 1 ♀, Soekanegara, 400-1000 m, ii.1940, native coll. (Buitenzorg Mus.); 1 ♂, 1 ♀, Djampang Tengah, 1934, native coll., M. E. WALSH ded.; 1 ♂, south of Soekaboemi, iii.1933; 1 ♂ Wijnkoops Bay, iii.1935, M. E. WALSH (all in coll. J. VAN DER VECHT).

East Java: 1 ♂, 1 ♀, Pasoeroean residency, Mt. Semeroe, southern slope, near Daroengan, ca 750 m, 6-13.vi.1941, on *Cyrtandromoea decurrens* (♀) and *Lantana camara* (♂), Mrs. M. & M. A. LIEFTINCK.

Holotype ♂ and allotype ♀: W. Java, Djampang Tengah, Bodjonglopong, 650 m, 16.ii.1941, Mrs. M. & M. A. LIEFTINCK.

♂. — Labrum of the usual shape, anterior border slightly upcurved, gently rounded; surface rather shiny, finely wrinkled and evenly covered with numerous superficial punctures of large size, the basal tubercles microscopically striate. Clypeus above dull, finely rugosely wrinkled, laterally slightly shiny, the entire surface moderately densely punctured, with a very low, rather broad, impunctate median longitudinal carina incomplete below; lateral portions of face slightly shiny, evenly, not densely punctured. Mandibles on the outside superficially striate-punctate. Malar space very narrow. Frons with faint indication of a median carina in the form of a elongate smooth line behind supra-clypeal mark; area frontalis, frons and vertex successively more finely and densely punctured, surface rather shiny, puncturation on vertex very dense, polished areas confined to a narrow ring roundabout the ocelli. Antennae moderately long, reaching a trace beyond the tegulae.

Thorax above and laterally closely, densely punctured, the punctures nearly contiguous, surface partially hidden under the pubescence; scutellum with distinct, impunctate median longitudinal carina; tegulae rather shiny, microscopically punctate.

Legs and wings without peculiarities; posterior tibia and basitarsus about as much dilated as in *cyrtandrae*.

Abdomen broadly oval, widest across apex of segm. 2, moderately convex above, apex rather obtusely rounded, dorsal surface usually with a distinct dullish, oleaginous shine, microscopically reticulate, puncturation well visible under the short pubescence, dense and fine, especially on first and second tergites but successively decreasing on following segments, the 5th only sparsely punctured; a narrow seam along apical margin of 2, and successively broader ones on following segments, without punctures; sternites shining, side-edges of 2-3 densely and finely punctured, these segments otherwise with few scattered punctures and with the apical margins impunctate; tergites 4-6 throughout densely finely punctured, along apical margin a narrow seam microscopically striate. Seventh tergite shaped as shown in fig. 40. Apical margin of 5th sternite distinctly though shallowly emarginate, the excision much wider and also deeper than that of the 6th (fig. 39). Seventh and 8th sternal plates shaped as in fig. 42 and 41, respectively. Genitalia fig. 43-44.

Head black. Light face-marks sharply pronounced, resembling closely those of ♂ *cyrtandrae*, the black patches on clypeus less widely separated on middle, the black at base of lateral portions of face also slightly more extensive (fig. 52); colour pinard- to apricot-yellow, labrum in fresh specimens sometimes with slight bluish intermingling; black border along apical margin of labrum always sharply defined, the basal line dark ferruginous, finely coalescent with the brown basal tubercles; basal two-thirds of mandibles on the outside yellow, then chestnut-coloured, apex black. Antennae black, scape lemon-yellow anteriorly; anterior face of distal one-third of third segment as well as those of all following joints, auburn.

Wing-venation dark greyish-brown, costal veins dark; membrane dilute yellowish. Tegulae bright orange-rufous.

Legs black, the femora and posterior tibiae on the inside very dark brown; anterior tarsi more or less orange-rufous, the apical tarsal joints ferruginous, tips of claws black; tibial spurs black.

Abdomen black, apical margins very dark brown (in old individuals they acquire a russet tinge, especially on the 2nd tergite); sternites also black, disk of 1st and apical margins of following segments dark ferruginous-brown.

Pubescence on head and thorax rather dense. Hair on labrum short and sparse, sub-erect, pale golden-yellow, as is also the rather longer

apical fringe. Outer margin of mandibles with a sparse fringe of light golden-yellow hairs. Clypeus, supra-clypeal area, and lateral portions of face very sparsely clothed with long, erect, black hairs. Hair on frons and vertex consisting of long erect black hairs, few in number, and a dense covering of much shorter, rather tufty, erect, orange-rufous pubescence; vertex with hairless areas in front of the ocellar triangle and on either side between lateral ocellus and orbits; pubescence along occipital border orange-rufous intermingled with black, behind the eyes similar but without admixture of black hairs. Soft feathery pubescence on underside of head very long, snow-white beneath. Scape of antennae with tufts of rufous hair on each side.

Dorsal pubescence of thorax and on upper parts of pleurae moderately long and dense, throughout rich orange-rufous in fresh specimens, not entirely concealing surface and sparsely intermingled with black hair dorsally; hair on both sides of scutellum, around the tegulae and on each side of propodeum longer, without admixture of black hairs.

Pubescence of legs sparse, not very dense, on coxae and trochanters of fore and middle legs rather long and light-coloured, all femora with short, mainly dark tomentum, the hind coxae and trochanter also dark; middle femur on the inside with a small apical tuft of orange-rufous hair; pubescence otherwise as described in the key.

Dorsal pubescence of abdomen black, very short and not nearly concealing surface, as described in the key; tergites 4-6 with longish, erect black hairs somewhat sparsely intermixed; white hair-bands on 2-4 narrow, that on 2 and 3 usually with distinct yellowish hue, becoming very narrow towards middle of segments, that on 4 slightly removed cephalad, each of the halves a little oblique, the shiny hairless apical margins thus appearing plainly visible mid-dorsally, no apical hair-fringe on 5-6, on 7 the apical processes with tufts of black hair. Venter with sparse, very fine, black tomentum and a sparse, sub-apical, fringe of somewhat longer, erect hair; sternite 5 and 6 (especially 5) more densely clothed with sub-appressed black pubescence.

♀. — Very similar to the ♂, but much larger and more robust. Differs from the ♂ in the following respects.

Labrum with the black on apical margin more extensive, the lateral margins also obscured, having, on middle apically, a diffuse, rusty-brown whisk attached to the black margin; labrum basally also more obscured, with a thick, dark brown or blackish stripe expanding on either side so as to cover the basal tubercles. Black patches on clypeus larger, only narrowly separated by a yellow stripe which almost reaches the fronto-clypeal suture; lateral yellow face-marks reduced to a short streak, widest above and tapering to a point beneath, placed along the clypeal suture, this area hence mainly black; transverse yellow mark on area frontalis

similar to ♂. Antennae short, just attaining tegulae, black, the first flagellar segment dark brown, the remaining joints cinnamon-rufous in front. Hair of labrum decidedly longer and more abundant, dark brown, glistening and rather more golden-brown in certain lights, apical fringe glistening orange-buff. Hair of face and dorsal surface of head much as in the ♂, only little denser, on occiput more conspicuous; long soft pubescence on underside of head not so dense and a little shorter, palest maize-yellow, almost or pure white beneath.

Structure and pubescence of thorax exactly as in the opposite sex.

Legs coloured as in ♂; posterior tibia and basitarsus greatly compressed; pubescence of anterior pair throughout orange-rufous, femora on the inside black-haired, short tomentum on the inside of all tarsal joints of fore legs sanford's brown; penicillus of posterior basitarsi glistening blackish-brown; pubescence otherwise as described in the key.

Disk of anterior wings more definitely stained with yellow than in the ♂.

Abdomen broad, oval, moderately convex above, widest across apex of 2nd segment; sculpture of dorsal surface similar to ♂. Pygidial plate nude, nearly always partly exposed, tongue-shaped, the lateral margins rather strongly upcurved especially towards base, margin itself sub-acute; surface of disk dull, dark reddish-brown, obscured in middle, slightly convex, sculpture superficial, consisting of a great number of fine striae, more or less arranged in transverse rows which are convex behind and successively more crowded together towards the apex, which is rounded. Colour of abdomen black, dull, without oleaginous shine, sculpture similar to the ♂ but punctures deeper and the apical margins of tergites narrower; puncturation of both tergites and sternites denser. Pubescence similar to the ♂, white sub-apical fascia of 4th tergite widest on middle, the appressed hairs only narrowly interrupted in the median line, black hair on 5th tergite longer and more abundant than on preceding segments, apical fringe dense with many of the hairs brown-tipped. Venter of abdomen deep black, basal sternites dark reddish-brown basally, apical margins narrowly dark ferruginous; pubescence as in ♂.

♂. Length 13.3, greatest width of abdomen 5.0, anterior wing 9.2 mm (holotype); 12.0-13.5, 4.8-5.0, 8.6-9.2 (paratypes); ♀ 16.2, 6.0, and 10.4 (allotype), 15.5-16.5, 5.7-6.0, and 9.0-10.0 mm (parallotypes). Tongue 15.0 mm (♂ paratype).

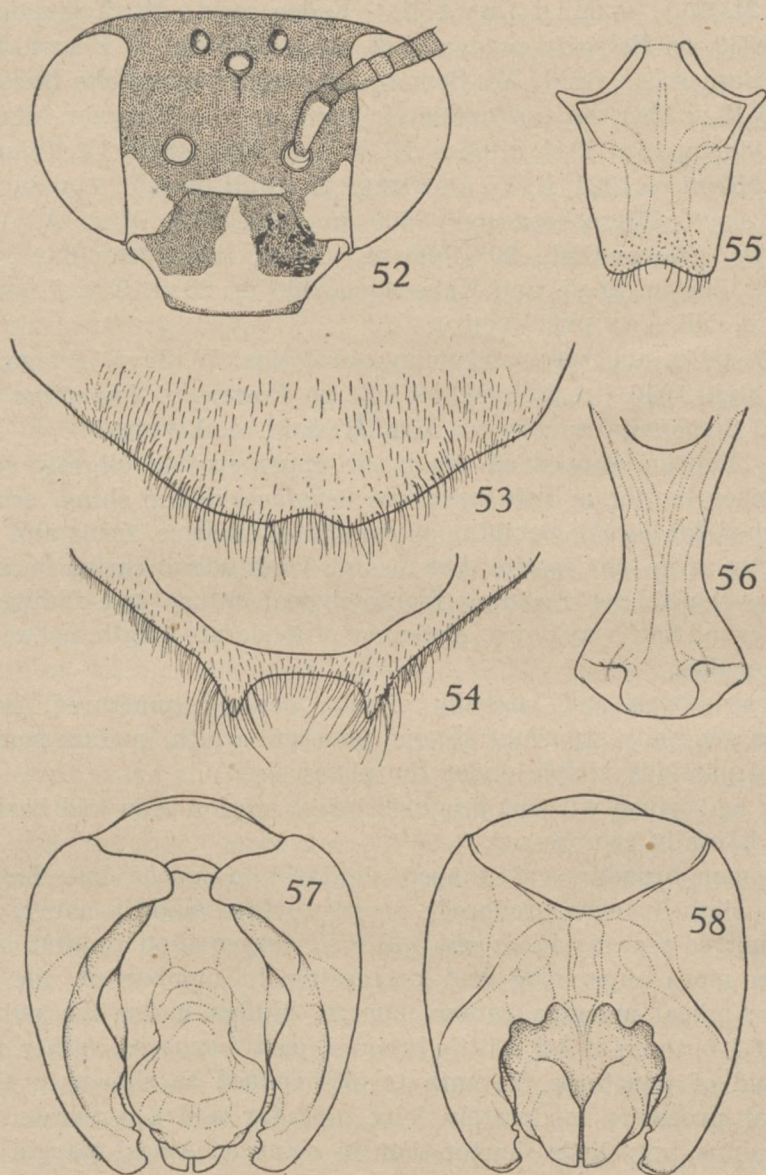
I have much pleasure in naming this fine new species after my friend JACOBUS VAN DER VECHT, who is well-known as a hymenopterist. *A. jacobi* is very easily recognised from other Javan species by the narrow white hair-bands that ornament the abdomen, which, for the rest, is entirely black. As far as I can ascertain it has no near allies, except, perhaps, the Indian *A. fimbriata* SMITH, which it resembles somewhat in general

appearance (see BINGHAM, 'Fauna of British India', fig. 180). It is, however, quite a different insect; thus, ♀ *fimbriata* has the face-marks white, not yellow, differing further very markedly from *jacobi* in that the dorsal pubescence of the vertex and thorax is grey, that of the propodeum being white, not bright orange rufous; the scopal hairs on the hind legs of *fimbriata* are black instead of orange-rufous in *jacobi*; it also differs in the apical two segments of the smooth and almost hairless abdomen being covered with a little hoary pile in fresh specimens only, whereas *jacobi* has definite — though narrow and obliterated — whitish fasciae at the apices of tergites 2-4.

Confined to the lowlands and submontane regions of Java and probably distributed all over the island; inhabits dense virgin and second growth forest and only rarely found outside these moist surroundings. In primary jungle it often occurs together with *A. feronia* sp. n., but in clearings and on sunny forest-bounded pathways it is often accompanied by blue-banded species of the *zonata*-group, though much scarcer than these and frequenting the highest flowers. Owing to the rapid deforestation of the lowland forests this will soon become a rare species. The known flower-records of *jacobi* have been enumerated above.

***Anthophora cyrtandrae*, sp. n. (fig. 52-58).**

Material studied. — West Java: 1 ♀, Buitenzorg residency, Mt. Salak, northern slope, Goenoeng Boender, 1100 m, 6.iv.1931; numerous specimens (both sexes), Buitenzorg residency, Mt. Panggerango, northern slope, Tjisaroea Z., 1000-1400 m, all the year round, 1938-1942; 1 ♀, Mt. Panggerango, southern slope, Siteo Goenoeng, 1000-1200 m, 7.viii.1939; numerous specimens (both sexes), Mt. Gedeh (Poentjak Pass), Telagawarna, 1450-1500 m, all the year round, 1938-1942; 1 ♂, 1 ♀, Mt. Gegerbintang (Poentjak Pass), 1300 m, 21.v.1939, on *Peristrophe bivalvis*; all Mrs. M. & M. A. LIEFTINCK. 1 ♂, 1 ♀, Mt. Gedeh, north-eastern slope, Tjibodas, 1400 m, 23-30.xii.1930 and 30.v.1937, M. A. LIEFTINCK. 3 ♂, 1 ♀, same locality, 16 & 23.v.1935, and 26-27.xi.1938, on *Coleus galeatus*, Mrs. E. & J. VAN DER VECHT; 1 ♂, Mt. Bèsèr, near Sindanglaja, 1300 m, 10.iii.1940; 1 ♂, 1 ♀, Mt. Gedeh, northern slope, Siteo Goenoeng, 1000 m, 16-20.ix.1940; 1 ♂, Mt. Gedeh, northern slope, 1200 m, 19.i.1933; all J. VAN DER VECHT (coll. VAN DER VECHT). 2 ♂ 2 ♀, Djampang, Lake Njalindoeng (south of Soekaboemi), 8-900 m, 6.viii.1939, on *Stachytarpheta jamaicensis*; 9 ♂ 9 ♀, Djampang, Mt. Malang, Tjiajoenan, 1000 m, 26.xii.1940 and 9.iii.1941, on *Coleus galeatus*, *Cyrtandra pendula*, and *Impatiens platypetala*; all Mrs. M. & M. A. LIEFTINCK. Numerous spec., Djampang, Mt. Tjisoeroe, 6-800 m, iii.1935, Mt. Tjimerang, xii.1932, Mt. Malang, 1000 m, ii.1935, & i.1940, ded. M. E.



Anthophora cyrtandrae, sp. n. ♂ Telagawarna, W, Java.

WALSH; 1 ♂, Djampang, Soekanegara, 900 m, 3.ii.1938, W. A. VAN DER NOORDAA, & ii.1940, ded. M. E. WALSH (Buit. Mus. & coll. VAN DER VECHT). 1 ♀, Priangan resid., Pengalengan, alt. ?, iv.1920 (*A. insularis* SM. det. MAIDL). — Mid Java: 1 ♂, Kedoe resid., Mt. Telemojo, 1200 m, 30.x.1939, on *Polygala venenosa*, M. A. LIEFTINCK. — East Java: 3 ♂, 1 ♀, Pasoeroean resid., Mt. Semeroe, southern slope, Lake Daroengan, 820 m, 6-13.vi.1941, on *Cyrtandra* cf. *cuneata*; 1 ♀, Tengger Mts., near Tosari, 1900 m, 15.vi.1941, all Mrs. M. & M. A. LIEFTINCK. 1 ♀, Idjen Mts., Blawan, 950 m, vi.1924, K. W. DAMMERMAN (Buit. Mus.); 1 ♂, same loc., western slope, Djeroekoendjoer, 400 m, 14.x.1939, Mrs. A. LUCHT; 1 ♀, Idjen, Blawan Est., 900-1500 m, v.1936, H. LUCHT; 6 ♀, Idjen, Kendeng, 1500 m, 26.vi. and Kalisengon, 900 m, 28.vi.1939, J. VAN DER VECHT (all coll. VAN DER VECHT).

Holotype ♂, allotype ♀ and many paratypes: W. Java, Telagawarna, 1450 m, 4.viii.1940 (♂) & 4.vi.1939 (♀), on flowers of *Impatiens chonoceras* and *Strobilanthes cernuus*, Mrs. M. & M. A. LIEFTINCK.

♂. — Labrum shaped as usual, the upper surface slightly concave and anterior border a little upcurved; surface rather shiny, sculpture as described for *jacobi*. Sculpture of mandibles, clypeus, frons and vertex also exactly as in that species, but median longitudinal carina on clypeus hardly developed, not reaching fronto-clypeal suture and fading away shortly beyond half-way down. Antennae of moderate length, not reaching beyond tegulae.

Thorax above and laterally closely, densely punctured, but the punctures generally separated by one puncture width, surface somewhat shiny and partially visible under the pubescence.

Legs and wings without peculiarities; posterior tibia and basitarsus strongly laterally compressed.

Abdomen broadly oval, shaped similarly to *jacobi*, but the apical segments slightly more produced; dorsal surface slightly shiny, puncturation not so fine as in *jacobi* and also deeper than in that species, punctures more superficial and decreasing in number on the apical segments; apical margins rather narrow, hidden under the pubescent fasciae of 1-3, those of 4-5 a little broader, partly exposed, rather smooth and devoid of punctures. Seventh tergite shaped as shown in fig. 54, the apical processes moderately long, not far apart, separated by a rounded sinus, very little shorter than in *cinnyris*. Apical margin of 5th sternite very shallowly and hardly noticeably excised on middle, that of the 6th broad, with a distinct, though small and shallow emargination, its surface smooth, very slightly longitudinally convex (fig. 53). Seventh and 8th sternal plates shaped as shown in fig. 56 and 55, respectively. Genitalia fig. 57-58.

Head black. Light face-marks sharply pronounced, arranged as

described in the key and as appears from fig. 52; black basal stripe and apical border of labrum slightly variable in width, usually sharply delimited, but occasionally narrow and rather diffuse, especially the basal line that may become unapparent; colour palest sulphur-yellow to light maize-yellow in discoloured specimens, never darker, the labrum usually with palest blue hue in fresh examples. Black patches on disk of clypeus variable in size, always short and distinctly divergent, the median yellow cone usually reaching upwards as far as the suture, occasionally ceasing a short distance before it. Basal three-fifths of mandibles on the outside yellow. Antennae deep black, scape sulphur-yellow in front, anterior face of flagellar joints dark brown, sometimes almost black. Thorax black.

Wing-venation dark brown; membrane greyish-yellow. Tegulae ochraceous-orange to tawny.

Legs black, the femora usually very dark brown (occasionally cinnamon-brown), anterior tarsi also more or less brown, claws orange-rufous, black tipped; tibial spurs black.

Abdomen brownish-black or black; the apical margins of tergites 2-3 narrowly, those of 4-6 somewhat more broadly, ochraceous-tawny and rather shiny, but entirely hidden under the dense pubescent fasciae; sternites mummy-brown, the 1st russet on middle, margins of sclerites and of sternites 2-4 ochraceous-tawny, that of 5th sternite very narrowly of that colour.

Hair on labrum sub-erect, thin and rather short, not very dense, glistening pale orange-yellow, as is also the somewhat longer apical fringe; a sparse fringe of very long pallid hairs along outer margin of mandibles. Clypeus and pale lateral face-marks rather sparsely clothed with long, erect black hair; upper (black) part of the lateral portions of face, and the frons more densely, clothed with tufts of ochraceous-tawny pubescence, these hairs of various size, those being longest and placed between the antennae and on either side of the lateral ocelli, erect and black-tipped, the shorter ones in front of the antennae and behind supra-clypeal mark; a rather transverse area in front of median ocellus and a smaller one on each side between lateral ocellus and orbit, almost nude; occipital margin densely fringed with black-tipped ochraceous hair, the shorter pubescence behind the eyes not intermingled with black and gradually acquiring a paler tint beneath, the long soft pubescence on lower part of temples almost pure white. Scape of antennae on each side fringed with ochraceous-tawny hair.

Pubescence of thorax comparatively long and dense, erect, somewhat irregular, dorsally not entirely concealing surface, hair on postscutellum and propodeum longer and denser, only sparsely intermingled with black; colour between xanthine-orange and mars-yellow in very fresh specimens but usually distinctly less bright.

Fore and middle legs on the outside clothed with short, rather dense, mostly appressed, ochraceous-tawny pubescence, on the inside with short mainly blackish tomentum; hair on coxae and trochanters rather long, light-coloured; fore and middle femora posteriorly with a marginal fringe of long, erect, light hairs. Pubescence of posterior femora dark brown, the knees above patella with a tuft of ochraceous-tawny hair; scopal hairs of posterior tibia ochraceous-tawny, apex above with a conspicuous, triangular tuft of much longer, ochraceous-buff, hairs; pubescence otherwise as described in the key.

Abdomen above with distinct transverse pubescent fasciae along apical margins of tergites 1-5, these bands not very sharply defined anteriorly; the longer more brightly coloured apical hairs being gradually replaced by shorter, slightly darker, and less numerous hairs basad to them; the apical fascia on the 5th tergite occupies almost all of the exposed surface; 6th and 7th tergites sparsely clothed with black hairs. Venter with sparse, very fine, appressed, light tomentum and a sparse sub-apical fringe of somewhat longer, sub-appressed, fulvous and black hair; sternites 5-7 more densely clothed with blackish pubescence, 5 moreover with a small lateral patch of light hair along apical margin.

♀. — Resembles the ♂ very closely, but differs as follows. Labrum with the black basal stripe always distinct and confluent on either side with the darkly coloured tubercles; apical margin more broadly bordered with black, the tip of the labrum usually dusky behind it; lateral margins often also obscured. Black patches on clypeus distinctly larger, extending further down, not so strongly diverging, separated in the median line by a narrow yellow stripe, tapered and almost pointed above, reaching fronto-clypeal suture; median longitudinal carina better pronounced than in ♂; lateral yellow face-marks reduced to a short streak, very similar to that of ♀ *jacobi*, along margin of clypeus. Antennae short, just attaining tegulae, black, the flagellar joints, except the first two, dark brown in front. Hair of labrum distinctly longer and more abundant than in ♂, light- to dark golden-brown, with glistening golden-yellow reflections in certain lights. Hair of face and dorsal surface of head rather denser and also somewhat deeper in tint than in ♂; long soft pubescence on temples pure white beneath.

Structure and pubescence of thorax not differing from ♂, hair of also very similar, marginal fringe on the inside of middle femora short, mainly blackish, growing paler towards apex; posterior tibia and basitarsus greatly laterally compressed, short black pubescence on the inside of basitarsus with a distinct mars-brown hue in certain lights, scopal hairs along upper margin of outer face of tibia not prolonged apically and not paler than the rest; penicillus glistening dark brown; otherwise as described in the key.

Disk of anterior wing more distinctly yellowish than in the ♂.

Abdomen broad, oval, not strongly convex above, widest across apex of 2nd segment; sculpture of dorsal surface similar to ♂, surface slightly shining under the pubescence. Pygidial plate usually only partially exposed, slightly downbent in side-view, nude, tongue-shaped, the lateral margins sharp, slightly raised, apex evenly rounded; surface of disk dull, dark reddish-brown, distinctly convex in middle, sculpture superficial, consisting of transverse striae which on the basal (unexposed) part are irregularly coalescent, resembling a finger-print fairly closely; on the exposed part the striae fade away towards the middle and apex of the plate, a narrow longitudinal area thus being almost without striae; toward the lateral margins the sculpture is more irregular, giving the surface more scaled appearance in certain lights. Colour of abdomen black, or nearly so. Pubescent fascia on tergite 2 occupying about the apical third, that on 3 the apical three-fifths; that on 4 somewhat removed cephalad and concave posteriorly, the apical margin in the middle plainly visible, ill-defined anteriorly, on the sides intermingled with numerous erect, fulvous and black hairs; exposed surface of 5th tergite above clothed with erect, blackish-brown and a little fulvous hair, replaced by fulvous hair on the sides, the apical fringe blackish-brown.

♂. Length 14.0, greatest width of abdomen 5.0, anterior wing 8.5 mm (holotype); 12.0-13.8, 4.9-5.3, 8.5-9.8 (paratypes); ♀ 14.5, 6.0, 10.6 (allotype), 13.0-16.3, 5.5-6.2, 9.0-10.6 mm (parallotypes). Tongue < 15 mm (♂ paratype).

This is a common mountain species, distributed all over the island of Java, but unless searched for in dense jungle, forest-clearings, gardens and second growth woods within striking distance of the virgin forest, *cyrtandrae* is but seldom met with and thus is much rarer in collections than is the case with many other bees which are more promiscuous in their flight habits. The altitudinal range of this species is not yet definitely known but so much is certain that no specimens have yet been found below ca 700 m above sea-level, the highest recorded altitude being 1900 metres. *A. cyrtandrae* is specially fond of visiting the flowers of various species of *Cyrtandra*, which usually thrive in damp shady localities; at Telagawarna it is very abundant during most of the year on *Impatiens chonoceras* and visits also *Didymocarpus barbata*, *Peristrophe bivalvis*, *Polygala venenosa*, *Strobilanthes cernuus* and *S. diclipteroides*, *Paraphlonis oblongifolia*, *Scutellaria javanica*, and *Coleus galeatus*.

Superficially, this species resembles the Javan *feronia* rather closely; but, a significant feature is that only very rarely does one meet with both these two species in any one place and that even in the few

known localities where the ranges of *cyrtandrae* and *feronia* seemingly overlap, they are largely mutually exclusive, *cyrtandrae* being common in the mountainous districts throughout the whole length of Java, whereas *feronia* only occurs in densely forested areas at low elevations.

A. cyrtandrae is probably the host of *Crocisa abdominalis* FRIESE, with which it occurs together, but no positive evidence to that effect can be given as nothing is known of the life history of *cyrtandrae*.

***Anthophora insularis* SMITH**

1858. SMITH, J. Proc. Linn. Soc. Zool. 2, p. 48-49.— ♀ N. W. Borneo (Sarawak).

1925. COCKERELL, Ann. Mag. Nat. Hist. (9) 16, p. 421.— Note on type in SAUNDERS' coll. (Oxford).

1927. COCKERELL, Ibid. (9) 20, p. 531-532.— Note.

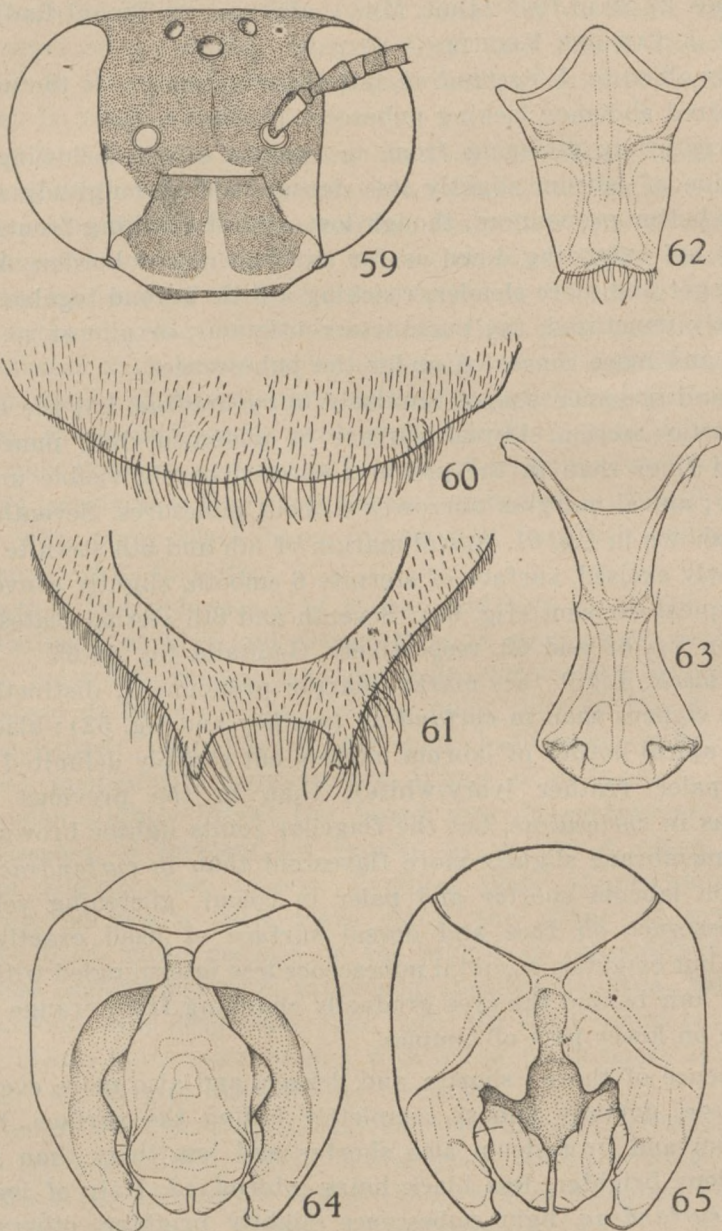
Although the original description of *insularis* is rather insignificant and unfortunately based on the female sex, the absence of pubescent fasciae on the abdomen of this species is evident. According to COCKERELL (1925), the type „has the abdomen appearing dull red, from a covering of extremely short red tomentum”. COCKERELL also considered that *insularis* agreed well with the description of *A. fulvohirta* MEADE-WALDO, type ♂ and ♀ from Singapore, and suggests that *fulvohirta* is the real *insularis*; at the same time he describes *A. insularis pendleburyi* ¹⁾ from Pahang, but fails to give any distinguishing characters, comparing it with *subinsularis* STRAND (from Bangalore) instead. Considering *A. subinsularis* to be a distinct species, COCKERELL adds: „Perhaps all these insects (*insularis*, *fulvohirta* and *pendleburyi*) are to be regarded as races of one species”, — but I am unable to agree with this view as the species falling within the *insularis* group, although obviously very closely related inter se, are quite distinct on close examination. So far as I am aware, species of this group will prove to be very numerous in Malaysia, and it seems advisable to keep all previously described species apart until someone may endeavour to publish careful re-descriptions; in critical species there appears to be no means of deciding on their synonymy unless the genitalia of the males be dissected and thoroughly compared.

The type of *A. insularis*, according to SMITH, measures 7 lines, that is 14.8 mm approx.

***Anthophora cinnyris*, sp. n. (fig. 59-65).**

Material studied. — Sumatra: 7 ♂, South Sumatra, Lampoeng residency, Giesting, foot of Mt. Tanggamoës, 5-600 m, ult. xii.1934 and ult. xii.1939 (4 ♂, on *Impatiens* cf. *oncidoides* and *Cyrtandra pendula*), and 21 & 27-29.iii.1940 (3 ♂, on *Impatiens* cf. *oncidoides*),

1) Originally named by COCKERELL *pahangensis* (nec MEADE-WALDO 1914).



Anthophora cinnyris sp. n. Lampongs, S. Sumatra.

Mrs. M. & M. A. LIEFTINCK, 1 ♀, N.E. Sumatra, Eastcoast Government, Deli, Tinggi Radja, alt. ? 18.vi.1939, P. VAN DER LAAN. Holotype ♂: Mt. Tanggamoes, 27-29.iii.1940 (Buit. Mus.), allotype ♀: Tinggi Radja, 18.vi.1939 (coll. J. VAN DER VECHT).

Closely allied to *A. cyrtandrae*, but differing mainly in the uniformly fulvous-haired abdomen lacking pubescent fasciae.

♂. Structurally differing from *cyrtandrae* in the following points. Punctuation of labrum slightly less dense; median longitudinal carina on clypeus better pronounced, though low, almost reaching fronto-clypeal suture but not extending down as far as the anterior border. Antennae slightly longer and more slender, reaching a little beyond tegulae. Thorax very densely punctured, the punctures contiguous, or almost so, surface less shiny and more concealed under the pubescence.

Legs and abdomen shaped similarly to *cyrtandrae*, but the abdomen with a flatter section. Dorsal surface of abdomen dull, punctuation denser and finer than in the previous species, barely visible under the pubescence; apical margins narrowly without punctures. Seventh tergite shaped as shown in fig. 61. Apical margin of 5th and 6th sternite broadly and shallowly excised, surface of sternite 6 smooth, slightly convex, with a minute apical excision (fig. 60). Seventh and 8th sternal plates shaped as shown in fig. 63 and 62, respectively. Genitalia fig. 64-65.

Head black. Light face-marks sharply pronounced, distinctly more reduced on clypeus than in *cyrtandrae* (see key and fig. 52); black basal stripe and apical border of labrum narrow but sharply delimited; colour generally paler (rather ivory-white), than in the previous species. Antennae as in *cyrtandrae*, but the flagellar joints lighter brown.

Wing-membrane slightly more flavescent than in *cyrtandrae*.

Hair on labrum shorter and paler in colour, glistening yellowish-white, pubescence on face and dorsal surface of head exactly as in *cyrtandrae* but brighter, occipital pubescence less intermingled with black, the shorter hair behind the eyes gradually changing from orange to pure snow-white on lower part of temples.

Pubescence of thorax shorter and denser, and also more even, than in *cyrtandrae*, dorsally almost completely hiding the surface, hair on postscutellum and propodeum also shorter and less tufty than in that species; colour brighter, less black hairs intermixed. Hair of legs very similar to *cyrtandrae*, light pubescence slightly brighter, otherwise as described in the key.

Dorsal tomentum of abdomen very different from *cyrtandrae*, the appressed hairs being evenly distributed over the whole surface, and at the same time finer and more abundant than in that species, concealing the surface almost completely. Venter with the appressed light tomentum

finer and still shorter, disk of sternites 3-6 mainly black-haired, the marginal fringe of 2-4 fulvous.

♀. The allotype differs from the ♂ almost in the same respects as the two sexes of *cyrtandrae* disagree from each other. Structurally it is identical to the ♂; as regards colour and pubescence, the following points may be emphasized.

Tip of labrum dusky behind the black apical border; basal tubercles dark brown, confluent with the basal black line. Black patches on clypeus practically alike those of ♀ *cyrtandrae*, the yellow median longitudinal stripe connected dorsally with the transverse superclypeal mark; lateral yellow face-marks very little shorter. Antennae attaining hind border of tegulae, the flagellar joints (except the first two) brown anteriorly. Hair of labrum dark brown, glistening yellowish in certain lights; hair of clypeus black, of lateral portions of face glistening yellowish with black tips. Frons and vertex with tufts of short, pale yellowish (not fulvous) hair between and on both sides of antennae, and with longer black hairs intermixed; long erect pubescence behind ocelli and on occiput ochreous with many black hairs intermixed; long soft pubescence on temples snow-white beneath.

Structure and pubescence of thorax and legs as in the ♂, hair of thorax distinctly shorter and denser than in *cyrtandrae*, dorsally with less black hairs intermixed; pubescence on mesopleurae beneath almost white instead of light fulvous. Femora paler than in the ♂, distinctly chestnut-coloured; penicillus of posterior basitarsus darker than in *cyrtandrae*, glistening brownish-black. Wings as in the ♂.

Abdomen slightly bright less broad than in *cyrtandrae*; sculpture and pubescence of tergites 1-4 exactly as in the ♂, tinge of dorsal tomentum slightly less bright. Pygidial plate shaped similarly to *cyrtandrae*; surface a little more shiny, the striae all arranged in transverse rows, more distinct on the middle of the exposed part but slightly less regular and more superficial towards the apex. Fifth tergite mainly clothed with deep black hair, only the sides being covered with longish, fulvous hairs intermingled with a few black ones; apical fringe also black; 6th tergite black-haired laterally.

♂. Length 12.9 (holotype), 12.7-12.9 (paratypes); greatest width of abdomen 5.0 (holotype), 4.8-5.0 (paratypes); anterior wing 9.2 (holotype), 9.0-9.2 (paratypes); ♀ length 14.0, width of abdomen 5.5, anterior wing 9.5 mm (allotype). Tongue 15 mm approx. (♂).

This little species, on direct comparison with other ones of the *insularis* group now before me, comes nearest to *cyrtandrae* sp. n., from which it is at once distinguished by the non pubo-fasciate abdomen. From the description of *A. insularis* SMITH it differs in being of smaller

size and in having the 5th abdominal tergite conspicuously black-haired (not „with a mixture of black hairs”); the other characters mentioned by SMITH are of no importance.

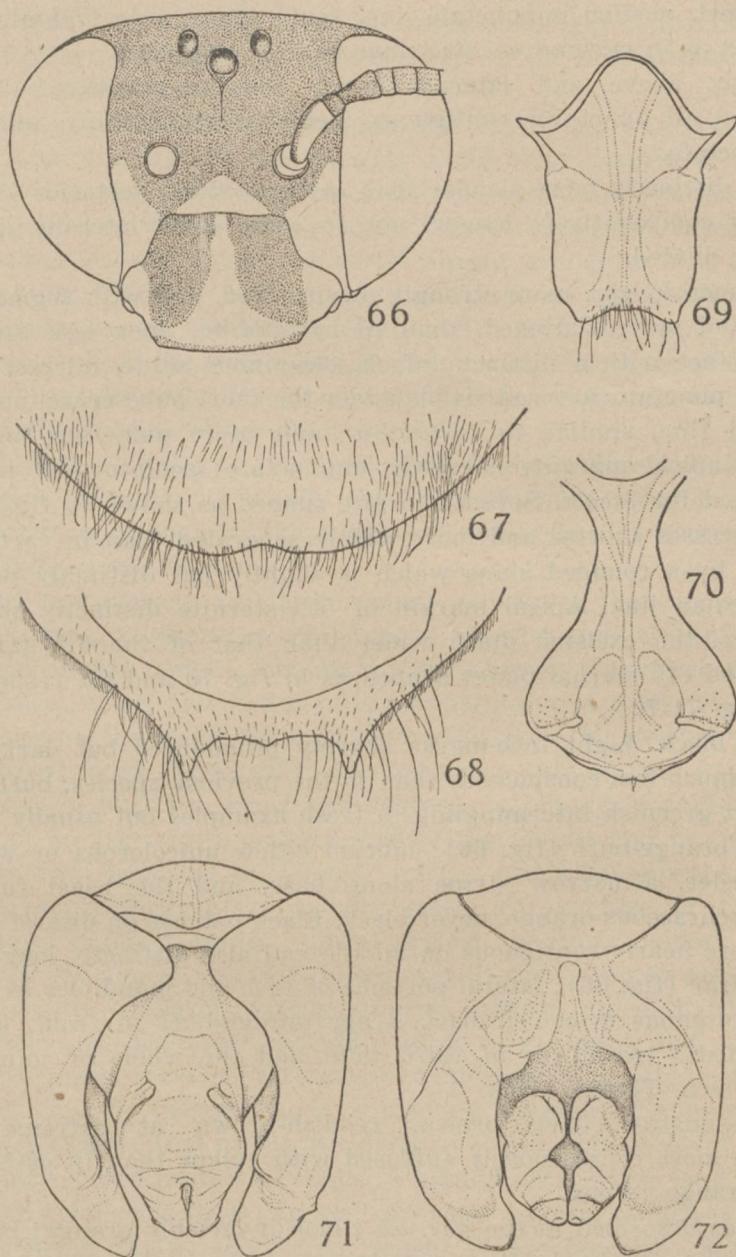
A. cinnyris may be the same as *fulvohirta* MEADE-WALDO, (type ♀ and ♂ from Singapore; ♂ ♀ Borneo). This species measures 15 mm for the body, otherwise the description fits our specimens rather closely. As the ♂ of *fulvohirta* was not described, the description of the ♂ being rather insignificant, I prefer to leave MEADE-WALDO's species as it now stands. (See COCKERELL's notes sub *insularis*, in the present paper).

***Anthophora feronia*, sp. n. (fig. 66-72).**

Material studied. — West Java: 1 ♀, Banten residency, S. Bantam, Mt. Madoer, west of Wijnkoops Bay, alt. ?, iii.1939, native coll., M. E. WALSH ded. 3 ♂, Buitenzorg resid., Djasinga, 100 m, Mirabaja, 2.iii & 30.iv.1941, on *Donax caniniformis* and *Costus speciosus*, Mrs. M. & M. A. LIEFTINCK; 1 ♀, Mt. Panggerango, northern slope, Tapos, 1200 (? m), 19.i.1933 (coll. J. VAN DER VECHT). 1 ♀, Mt. Salak, Perbakti, ca 800 m, 28.vii.1922, H. H. KARNY. 1 ♂, 1 ♀, Djampang Koelon Tjiajoenan, alt. ? iv.1939, and 2 ♀, Djampang Tengah, Mt. Tjimerang, ca 600 m, xii.1932 and Bidjilan, ca 250 m, vii.1939, all native coll., M. E. WALSH ded. (Buitenzorg Mus.); 1 ♂, Wijnkoops Bay, iii.1935, and 1 ♂, 3 ♀, Djampang, south of Soekaboemi, Mts. Tjisoeroe and Tjimerang, 6-800 m, iii-iv.1933 and iii.1935, M. E. WALSH ded. (coll. J. VAN DER VECHT); 9 ♂, Djampang Tengah, Bodjonglopang, 650 m, 14.vii.1940, 29.xii.1940, 1.i.1941 & 16.ii.1941, on *Coleus galeatus*, *Achyrosperrum densiflorum*, *Globba marantina*, and *Polygala venenosa*, Mrs. M. & M. A. LIEFTINCK; 2 ♂, 4 ♀, Soekanegara, alt. ? ii.1940, native coll. M. E. WALSH ded. (Buitenzorg Mus.). 1 ♂, Priangan resid., Radjaman-dala, 350 m, 10.iii.1940, J. OLTHOF (Buitenzorg Mus.). East Java: 2 ♀, Pasoeroean residency, Mt. Semeroe, southern slope, near Daroengan, ca 750 m, 6-13.vi.1941, on *Cyrtandra pendula*, Mrs. M. & M. A. LIEFTINCK.

Holotype ♂: W. Java, Djampang Tengah, Bodjonglopang, 650 m, 16.ii.1941, Mrs. M. & M. A. LIEFTINCK; allotype ♀: Djampang Tengah, Mt. Tjimerang, 600 m, xii.1932, M. E. WALSH ded.

♂. Head a little larger than in *cyrtandrae* with the face longer and distinctly more prominent. Labrum shaped similarly to the previous species; surface rather dull, distinctly microscopically reticulate and sparsely covered with large, shallow, scattered punctures fewer in number than in *cyrtandrae*, the basal tubercles microscopically striate. Clypeus above dull, coarsely rugosely wrinkled, moderately densely and rather deeply punctured, laterally shiny with few scattered punctures, median carina well developed, complete, not acute, impunctate; lateral



Anthophora feronia, sp. n. Djampang, W. Java.

portions of face shiny, with a few scattered punctures. Mandibles on the outside finely longitudinally wrinkled. Malar space vestigial. Frons with a fine, short, median impunctate line; sculpture of area frontalis, frons and vertex as in *cyrtandrae*; antennae as in that species.

Thorax above and laterally more densely punctured than in *cyrtandrae*, all punctures contiguous. Tegulae rather shiny, microscopically punctate.

Legs distinctly more slender than in *cyrtandrae*, posterior tibia and basitarsus comparatively longer, not so compressed laterally and less noticeably dilated.

Abdomen longer, more strongly downcurved, and with segments 3-5 broader and more flattened, than in *cyrtandrae*, apex less produced; dorsal surface with a distinct dullish, oleaginous shine, microscopically reticulate, puncturation well visible under the short pubescence, punctures dense and fine, similar to *cyrtandrae*, but more numerous on apical segments, apical margins narrowly impunctate; sculpture of sternites as described for *jacobi*. Seventh tergite shaped as shown in fig. 68, the apical processes shorter and more widely separated than in *cyrtandrae*, separated by a rounded sinus which is slightly but distinctly produced in the median line. Apical margin of 5th sternite distinctly shallowly emarginate, the excision much wider than that of the 6th (fig. 67). Seventh and 8th sternal plates shaped as in fig. 70 and 69, respectively. Phallus fig. 71-72.

Head black. Light face-marks sharply pronounced but darker, and therefore much less conspicuous than in the previous species, buff yellow with slight greenish intermingling in fresh examples but usually various shades of orange-buff (fig. 66); labrum either unicolorous or with the apical border, a narrow stripe along base, and the basal tubercles, diffusely ochraceous-orange, never black. Black patches on disk of clypeus larger, more nearly contiguous on middle and also distinctly longer than in *cyrtandrae* (fig. 66); lateral portions of face and mandibles as in that species. Antennae brownish-black, scape orange-buff in front, anterior faces of distal two-thirds of third joint and the whole of joints 5-13 reddish-brown. Thorax black.

Wing-venation dark brown, reddish-brown at extreme base; membrane more conspicuously suffused with yellow than in *cyrtandrae*. Tegulae orange-rufous.

Legs as described in the key, all tibiae invariably orange; basitarsi dark brown (anterior basitarsi sometimes dusky orangish), remaining tarsal joints dark rufous, the claws black-tipped; tibial spurs chestnut-coloured.

Abdomen above brownish-black or black, the apical margins of tergites 2-6 rather broadly dark ochraceous-tawny, showing somewhat through

the pubescent apical fasciae (in worn specimens the apical margins of the tergites are distinctly more broadly ochraceous-tawny in colour, forming indistinct apical bands); sternites dark brown, the 1st and 2nd chestnut-brown on middle, margins of sclerites and of sternites 2-5 rather broadly ochraceous-tawny.

Hair on labrum as in *cyrtandrae* but rather more golden-yellow or orange; sparse fringe of long bristles along outer margin of mandibles similarly coloured. Long erect black hair on clypeus and lateral portions of face golden-brown in certain lights, otherwise similar to *cyrtandrae*; tufty pubescence on frons and vertex bright orange-rufous, the longer hairs mainly black or black-tipped; occipital margin densely fringed with salmon-orange, sparsely intermingled with black, hair, the shorter pubescence behind the eyes changing from orange or orange-buff to pale orange-yellow beneath. Scape of antennae on each side conspicuously fringed with orange-rufous hair.

Pubescence of thorax less tufty than in *cyrtandrae* but longer than in *cinnyris*, dorsally not wholly obscuring surface, colour brighter and more conspicuous than in these species; pubescence of pleurae beneath orange-buff, never whitish.

Legs less densely and more evenly pubescent than in *cyrtandrae*, hair on coxae, trochanters and femora shorter and less tufty, mostly orange; posterior femora with mainly dark brown tomentum, pubescence on the knees above patella not tufty; scopal hairs of posterior tibiae and pubescence on the inside throughout orange, only the two ventral carina black-haired, apex above without conspicuous tuft of pale hairs. Dorsal pubescence of abdomen short and sparse, not obscuring surface, mainly black, but on 1st tergite on each side of the middle and in front of the apical margin replaced by longer, erect, fulvous pubescence, which is denser and rather tufty on both sides, the surface of the tergite remaining visible; orange apical fascia narrow, widest laterally, constricted or almost so on mid-dorsum and consisting of sub-appressed hairs; tergites 2-4 each with a similar, narrow, apical hair-band, not very clearly defined anteriorly, that on 2 very narrow but complete in fresh specimens, those on 3-4 narrowly interrupted at middle and rather widened laterally, these bands occupying roughly the apical $\frac{1}{4}$ to $\frac{1}{5}$ of each tergite, that of the 4th paler in colour than those of preceding segments; exposed portion of tergite 5 basally with rather long, sub-erect, black hairs, followed by a narrow transverse band of golden-yellow hairs (most conspicuous at the sides), apical fringe blackish; 6th and 7th tergites sparsely clothed with longish, black hair. Venter almost nude, disk of sternite 1-3 with few scattered, erect hairs, and sides of 2-4 with very fine, appressed light tomentum; sternites 4-6 more densely clothed with appressed blackish pubescence; apical hair-fringes thin and short, light brown.

♀. — Closely resembling the ♂ in most respects, differing as follows. Dark patches on clypeus usually dark reddish-brown instead of black, each of them a little wider than in the ♂; lateral yellow face-marks scarcely smaller than in the ♂ and hence occupying considerably more of the surface than in *cyrtandrae* and *cinnyris*. Antennae short, just attaining tegulae, blackish-brown posteriorly; scape in front basally dark reddish brown, but at least the distal one-half (often almost the entire anterior face!) orange-yellow; apex of third joint and joints 5-12 light to dark reddish-brown anteriorly. Hair of labrum longer and denser than in ♂, glistening golden-yellow; hair of face and frons denser and longer, dark golden-yellow without any black hairs intermixed. Structure and pubescence of thorax and legs as in the opposite sex; colour of legs, especially of the femora, distinctly paler (dusky orange); marginal hair-fringe on the inside of middle femora very short, bright orange; posterior tibia and basitarsus less laterally compressed than in *cyrtandrae*, scopal hairs along upper margin and outer face of tibia longer and denser but otherwise similar to the ♂ (see description in the key).

Abdomen broad, oval, more strongly downcurved and more convex dorsally than in *cyrtandrae*, widest across apex of 2nd segment; sculpture and colour of dorsal surface similar to the ♂ but the surface less shiny. Pubescence not denser but decidedly softer and finer than in *cyrtandrae*, resembling that of the ♂ rather closely, but differing in that the fine black pubescence on the disk of the tergites 2-4 is more restricted to the middle of the segment and largely replaced by fulvous; the orange apical pubescent fasciae of these segments are broader than in the ♂ and not constricted or obliterated at middle, occupying roughly one-third of the exposed surface: but, on account of the greater admixture of brown hairs on the anterior portions of the tergites, these bands appear less sharply delimited than in the ♂, and much less so than in both sexes of *cyrtandrae*. Fourth tergite with an admixture of sub-erect orange hairs; 5th tergite with the basal pubescence long and black-coloured, changing to tawny or russet towards apex, the apical fringe acquiring a sudan-brown or russet tinge; 6th tergite laterally clothed with similarly coloured hair. Pygidial plate usually only partially exposed, almost straight in side-view, nude, shaped similarly to *cyrtandrae*, sculpture as in that species, the fine transverse striae on the unexposed (basal) part irregularly coalescent towards the middle, greatly resembling a finger-print, thence gradually more convexly curved posteriorly, usually fading away and indistinct apically but covering the entire surface.

♂. Length 14.0, greatest width of abdomen 5.0, anterior wing 9.4 (holotype), 14.0-15.0, 5.2-5.7; 9.6-10.0 (paratypes); ♀ 16.0, 5.7, 10.5

(allotype), 15.5-16.3, 5.8-6.2, 10.5-10.7 mm (parallotypes). Tongue 15.8 mm (♂ paratype).

Anthophora anthreptes, sp. n. (fig. 73-79).

Material studied. — Sumatra: 5 ♂, 6 ♀, Sumatra. Lampoeng residency, Giesting, foot of Mt. Tanggamoës, 500-600 m, ult. xii.1934 (2 ♂), ult. xii.1939 (2 ♂, 2 ♀, on *Cyrtandra pendula*), and 19.iii.1940 (3 ♀ on *Zingiberaceae*, 1 ♀ on *Cyrtandra pendula*, 1 ♂ on *Impatiens* cf. *oncidoides*), all Mrs. M. & M. A. LIEFTINCK. Holotype ♂ and allotype ♀ : Mt. Tanggamoës, ult. iii.1940.

Structurally most closely resembling *feronia* sp. n., but differing in the uniformly fulvous-haired abdomen, the tergites bearing no pubescent fasciae.

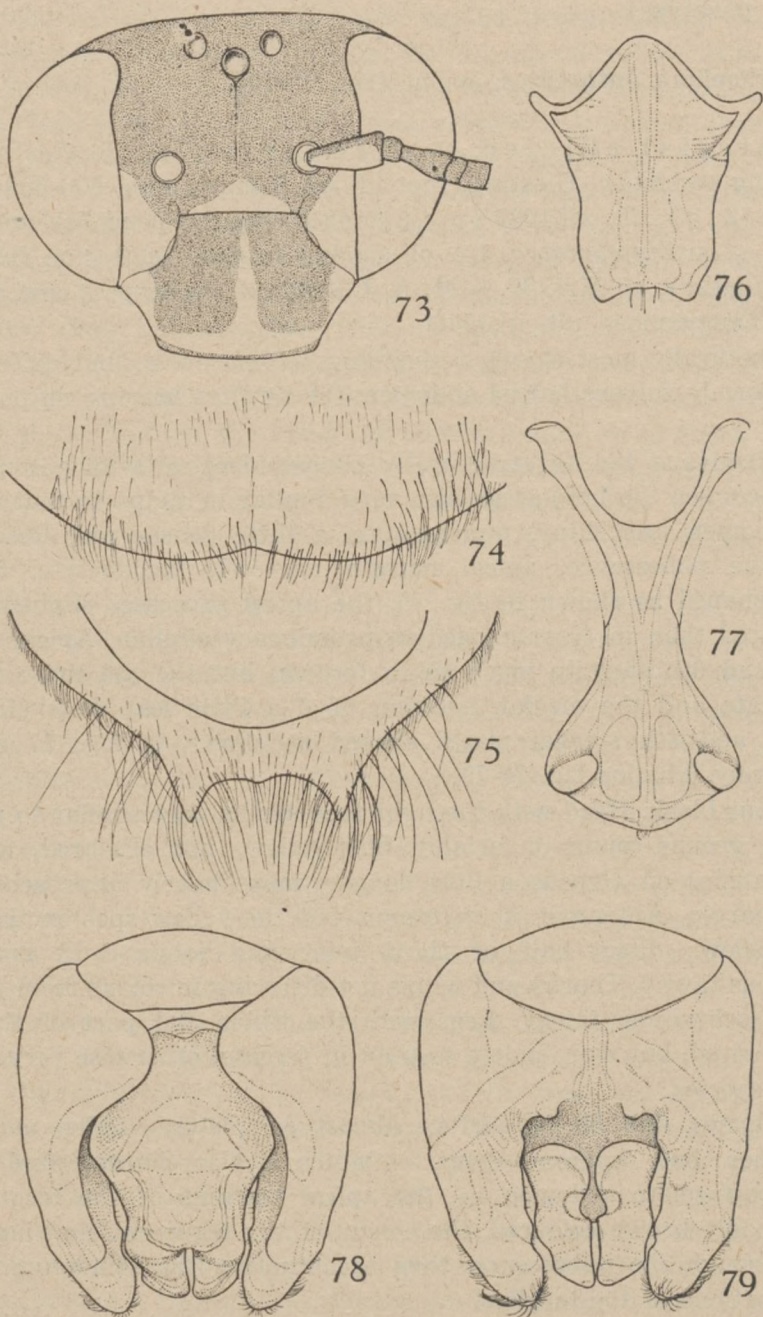
♂. Head and thorax structurally almost identical with *feronia* (for differences see the key); legs also very similar in shape to that species.

Abdomen less shiny, puncturation a little denser and less visible under the pubescence, apical margin narrowly impunctate. Seventh tergite shaped as shown in fig. 75, the apical processes slightly better pronounced than in *feronia*, median prominency similar. Apical margin of 5th and 6th sternite much as in *feronia*, but the 5th more broadly emarginate and the median excision of 6 a little less deep (fig. 74). Seventh and 8th sternal plates shaped as shown in fig. 77 and 76, respectively. Phallus fig. 78-79.

Colour black. Head with the light face-marks very similar to *feronia*, but the ground-colour invariably buff-yellow, not obscured, and the black patches on clypeus a little longer, more nearly approaching the apical margin. Antennae as in *feronia*, but the yellow spot on the scape paler yellow; distal half of third joint and joints 5-13 anteriorly ochraceous-tawny. Thorax and wings not differing in colour from *feronia*. Tegulae ochraceous-tawny. Legs with the tibiae and part of the tarsi light-coloured, but more palely so than in *feronia*, otherwise very similar to that species.

Abdomen dull black, surface almost completely hidden under the pubescence; but, unlike *cinnryis*, — which is also characterized by the non pubo-fasciate abdomen —, the apical margins of the tergites are very broadly brown-coloured, the colour of the tegument showing somewhat through the pubescence, thus accentuating the tomentum on the distal portions of the tergites.

Pubescence on labrum and face as in *feronia*, the fulvous hairs on frons and vertex less bright and many of the shorter light hairs on the vertex are obscured or replaced by blackish hairs; hair on occiput also less bright than in the preceding species, with numerous black hairs



Anthophora anthreptes, sp. n. Lampongs, S. Sumatra (no. 603).

intermixed, behind the eyes gradually changing from ochraceous-tawny to almost pure snow-white. Dorsal pubescence of thorax slightly denser but not longer, than in *feronia*, definitely less bright than in that species and on mesonotum with numerous black hairs intermixed. Hair of legs very similar, coloured as described in the key.

Dorsal tomentum of abdomen very different from *feronia*, resembling *cinnyris* rather closely, the appressed hairs being evenly distributed over the whole surface, and at the same time denser and a little longer than in *feronia*, concealing the surface almost completely. Long sub-erect pubescence on the 6th tergite black, not very conspicuous on account of these segments being usually concealed under the preceding tergite. Venter, towards the apical margins of the tergites, more densely clothed with appressed fulvous tomentum than in *feronia*.

♀ — Resembles the ♂ very closely, but differs as follows. Labrum nearly always of a dirty cinnamon-buff tinge (discoloured), approaching the condition found in *feronia*, but less orangish, its margins rather ferruginous; the yellow of the face deeper than in the ♂ and the black patches still longer (more closely approximated and occupying more of the clypeal surface than in ♀ *feronia*), the median yellow stripe tapering to a point and not always extending as far upwards as the fronto-clypeal suture; transverse yellow mark on area frontalis small, triangular, considerably smaller in size than in the opposite sex and also much smaller than in the ♀ of *feronia*. Lateral face-marks shaped as in *feronia* ♀, truncated above. Antennae attaining anterior border of tegulae, the scape very dark brown, but the entire anterior face orange-rufous, as is also the apex of the third joint and the flagellar joints 5-12. Hair of labrum distinctly more numerous and longer than in ♂, glistening orange; hair of clypeus and frons variable in colour, always brighter than in ♂, the long hairs usually black or dark brown, slightly orangish basally, but occasionally with rather bright orangish reflections in certain lights (clypeus never fulvous-haired as in *feronia* ♀!); pubescence on upper surface of head similar to the ♂; long soft pubescence behind the eyes pale orange-buff fading to pale yellow-orange on the temples beneath.

Pubescence of thorax and legs as in ♂, that on mesopleurae beneath ochraceous-buff, never whitish; colour of legs, especially of the femora, definitely paler, tawny or (rarely) cinnamon-brown; legs otherwise as described in the key.

Abdomen broad, oval, much less downcurved and with a definitely flatter section than in *feronia*, widest across apex of 2nd segment, the apical segments more evenly narrowed and the apex more pointed, than in that species. Colour and pubescence exactly as in the ♂, the broad pale-coloured apical margins showing somewhat through the dense

pubescence, giving the abdomen a quasi-fasciate appearance. Fourth tergite with a sparse admixture of longer erect, arcuate, fulvous hairs; pubescence of 5th tergite sub-erect and rather longer than on preceding segments, especially on the sides, but not different in colour except along apical margin, where the hairs are of a slightly deeper ochraceous-orange tint ¹⁾; 6th tergite dark reddish-brown, laterally clothed with short, recumbent, glistening golden ochraceous-orange hairs. Pygidial plate exposed, nude, basally chestnut-brown, exposed portion blackish-brown, slightly convex in side view, shaped similarly to *feronia* but a little narrower apically, sculpture very similar to *feronia*, but the transverse striae about the middle and apical two-fifths of the plate not convexly rounded off posteriorly but bent inwards and backwards on either side of the middle so as to converge towards the median line, running parallel to the long axis of the plate, becoming obsolete shortly after the middle of its length.

♂. Length 15.6, greatest width of abdomen 5.3, anterior wing 10.3 (holotype); 14.0-14.7, 5.3-5.5, 10.3 (paratypes); ♀ 18.0, 5.9, 10.6 (allotype); 17.0-17.8, 5.5-6.0, 10.0-10.5 mm (parallotypes). Tongue ? mm.

SUMMARY BY EDITOR

The author has made a number of wild living bees the object of his study, the result of which is put down in the present paper. It is largely based on investigations carried out on the *zonata* group of *Anthophora* by T. RAYMENT. It became evident, however, that the specific differences in the male genitalia and apical sternites are so slight as to be of little practical value, even to the specialist. Still, they are more valuable and better reliable character than colours and pilosity, which may fade or be rubbed off.

Besides the anatomical differences the biology of the species at hand was carefully studied. It proved that many of the rarer forest inhabiting *Anthophorids* were entirely dependent on certain kinds of flowers. The author predicts that a subsequent morphological study both of these flowers and of the bees themselves will throw fresh light on the question which flowers peculiar to dense primeval forest are dependent on bees for cross-fertilisation and which are not. The development of the enormously long mouth parts of the *Anthophora* species is correlative with other adaptations, and serves to the feeding on long flower tubes.

1) It is interesting to note that in two parallotypes (19.iii.1940), which otherwise do not differ in the slightest way from the remaining females, most of the sub-erect hairs on the middle of the 6th tergite, instead of being all light brown, are brownish-black intermingled with fulvous (one), or deep black (the other), with only the lateral hairs pale in colour.



Fig. 1—2. *Callomelecta vulpecula* sp. n. ♂ ♀. 3—4. *C. insidiosa* sp. n. ♂ ♀. 5—7. *Habropoda impatiens* sp. n. ♂ (2 vars.) ♀. 8. *H. erratica* sp. n. ♀.

The specimens that were made use of are the greater part incorporated in the Buitenzorg Museum, and many others were in the private collection of Dr. J. VAN DER VECHT at Buitenzorg.

The paper is richly illustrated: the line-drawings are original camera lucida sketches; the photographs have been made by the Institute's photographers, Messrs. H. & F. HUYSMANS.

The species dealt with and the known food are following here.

<i>Species:</i>		<i>food:</i>	
1.	<i>Callomelecta pendleburyi</i> CKLL.	unknown	
2.	— <i>vulpecula</i> n.sp.	on <i>Polygala</i> and <i>Impatiens</i>	} but supposed to be parasites of <i>Habropoda</i>
3.	— <i>insidiosa</i> n.sp.	on <i>I. chonoceras</i> and <i>platypetala</i> .	
4.	<i>Habropoda impatiens</i> n.sp.	on <i>Impatiens</i> sp. (S. Sumatra)	
5.	— <i>erratica</i> n.sp.	on <i>I. chonoceras</i> (W. Java)	
6.	<i>Anthophora bouwmani</i> n.sp.	unknown	
7.	— <i>hanitschi</i> M.-W.	on <i>Lantana Camara</i>	
8.	— <i>elephas</i> n.sp.	on <i>Phacomeria solaris</i> and <i>L. Camara</i>	
9.	— <i>jacobi</i> n.sp.	on 8 different plants	
10.	— <i>cyrtandrae</i> n.sp.	on 10 different plants and more	
11.	— <i>insularis</i> Sm.	unknown	
12.	— <i>cinnyris</i> n.sp.	on <i>Impatiens</i> sp. and <i>Cyrtandra pendula</i>	
13.	— <i>feronia</i> n.sp.	on 6 different plants	
14.	— <i>anthreptes</i> n.sp.	on <i>Impatiens</i> sp., <i>Cyrtandra pendula</i> and a <i>Zingiberacea</i>	

A key to identify the species of one genus is included.

ON SOME DELIAS FROM THE SNOW MOUNTAINS IN NEW GUINEA

(Lep., Pieridae)

by

L. J. TOXOPEUS

(Buitenzorg, Java).

Amongst some old material of the Buitenzorg Museum I found four specimens of the Pierine genus *Delias* which were unlabelled and rather worn. They proved to be very interesting, though, chiefly from the viewpoint of reconstructing their locality and time of capture.

The mounting and the pins made sure that the butterflies had belonged to one lot and their affinities told me at once „New Guinea high mountains” to be their place of origin.

Since *Delias* changes its outlook with every mountain district of New Guinea, it was worth-while to enter into a closer investigation of the habitat.

This was not so difficult as it looked. All the Museum material from New Guinea which was not labelled otherwise, had been collected during the military explorations between 1909 and 1914, chiefly by A. DUMAS. Keeping this in mind and noting that one of the specimens belongs to a group of species which exclusively inhabits regions at and above 2000 m, there solely remained the question where and in which year the military exploring force reached a point or points lying above that altitude. The map of Dr. KLEIN's review of New Guinea explorations (designed by C. C. F. M. LE ROUX) gave the final clue, telling with absolute accuracy that explorations of 1911 went as far as the headwaters of the Andreae River and only there crossed the 2000 m limit. DUMAS was accompanying the force as a zoologist.

Further proof was given by the specimens themselves, which I will discuss hereafter. There are four species, so each is represented by one specimen only.

1. *Delias nais nais* JORD. 1911.

1 ♀. White part of forewing underside extends into submedian area, in so far tending towards the subspecies *rubrina* VAN EECKE from Mt. Wilhelmina, southern slopes. Typical *nais* JORDAN was described from Mt. Goliath.

D. nais goes upwards from \pm 1500 to 2300 m.

2. *D. eichhorni soror* n. subsp.

1 ♂. Differs from *D. eichhorni frater* JORD. from Mt. Goliath in having a black forewing upperside, except one little apical white spot and a whitish suffusion between the cell and the middle of the dorsum.

The black apical border of the hindwing is very broad, but quickly tapers and vanishes at the border in the middle between V_2 and V_3 , showing a white incision between V_3 and V_4 . On the underside of the hindwing the submarginal spot in 5 is a long lying oval, instead of a standing oval as with *frater*. In other points identical with JORDAN's subspecies from Mt. Goliath.

Amongst JORDAN's material there was one ♂ specimen like the above-described form. It is often the case with an adjoining subspecies that it brings forth the typical form of a neighbour as a rare variety. The fact that each of the four specimens before me shows slight differences to JORDAN's types has strengthened my opinion that we have to deal with a subspecies here and not with a variety. *D. eichhorni* occurs not rarely between 2300 and 2700 m altitude.

3. *D. catisa catisa* JORD. 1911.

1 ♂. Differs from Mt. Goliath *catisa* in the black border of the forewing underside reaching the tornus and the black cell-closing spot fusing more broadly with the black border. In the hindwing the marginal spot in 5 is not elongated to the fringe. These differences are too insubstantial to base a new name on them.

D. catisa is a rare species. I found it N. of Mt. Wilhelmina between 1800 and 2700 m.

4. *D. catocausta* JORD. 1911.

1 ♂. Differs from typical ♂♂ in having the discocellular bar of forewing well separated from the apical triangle. There is one very small diffuse white apical spot. On the hindwing underside the white inward edge to the black marginal border is only represented by some diffuse white scaling in cells 2-4. The abdominal area is black densely irrorated with yellow scales. The white tornal suffusion of the forewing underside is much reduced, the white spot outside the discocellulars is only vestigial.

Here again I was inclined to name a new subspecies, but considering the possible variation of the above-mentioned distinguishing characters, I refrained from doing so.

D. catocausta belongs to a group of high mountain species. I found one new species of this group N. of Mt. Wilhelmina between 2300 and 2700 m, and another new species at 2300 and 2150 m. A third new species was discovered near the Wissel Lakes by Dr. H. BOSCHMA in 1939 (one specimen, upwards from Araboe Camp, probably at an altitude of 2100 m).

It is the presence of *catocausta* which forced me to believe the 4 specimens were caught above 2000 m.

The supposed place of capture, the headwaters of Andreae R., lies at a distance of only forty miles W. from Mt. Goliath (as the crow flies), but this is sufficient in the high mountains of New Guinea to bring about well-established new subspecific forms.

SUMMARY BY EDITOR

Amongst some old material of the Buitenzorg Museum the author found four *Delias* specimens, belonging to four different species. Although they were unlabelled and rather worn, they proved to be very interesting, because they proved that it is possible to locate any given New Guinea mountain species of *Delias*, by studying its subspecific features.

One of the above-mentioned specimens belonged to a group of species which exclusively inhabits regions at and above 2000 metres, and as the specimens were captured during the military explorations of New Guinea, the question was put where and when the explorers reached such altitudes.

It was found out that this was at the headwaters of Andreae River, in the year 1911, and that DUMAS must have been the collector.

These data derived from maps and other informations were put to the test by comparing the specimens themselves with the existing subspecies descriptions and with specimens available in the Museum. This investigation brought to light that all specimens were nearest to forms described from Mt. Goliath by JORDAN (1911). The supposed place of capture, the headwaters of Andreae River, is at a distance of only forty miles W. from Mt. Goliath (as the crow flies), so the forms are naturally very similar.

This distance, however, is far enough to produce visible distinctions in New Guinea. Therefore, although three out of the four species were attributed to existing local forms, one of them was described as a new subspecies.

The names of the present species are the following:

1. *Delias nais nais* JORD. 1911
2. — *eichhorni soror* n.subsp. (nearest to *eichhorni frater* JORD.)
3. — *catisa catisa* JORD. 1911
4. — *catocausta* JORD. 1911 (exclusively found above 2000 m).

NEWLY HATCHED VARANUS KOMODOENSIS

by

DR. J. K. DE JONG
(Batavia).

In 1938, TÄNZER and VAN HEURN published a paper (this Journal, 16, p. 365), describing the mating and depositing of the eggs of *Varanus komodoensis* OUWENS in the Soerabaia Zoological Garden. The eggs failed to hatch and only some embryonic material in more or less advanced stages of decomposition, hardly furnishing any basis for further examination, remained.

It was hoped that some following year the garden might show the hatching of the eggs of this giant lizard, but as yet no such thing has happened.

The Zoological Garden in Batavia was more lucky in this respect and on April 15th 1941 two newly hatched Komodo-lizards could be shown to the public.

As the young of *Varanus komodoensis* are as yet unknown to science and as they exhibit an interesting and unexpected colour-pattern, it may be worth while to describe them in some detail here.

The Komodo-lizards kept in the Zoological Garden of Batavia were captured in the hills round the small native village of Kenari on the west-coast of the island of Flores in June 1937. They arrived in Batavia during the first days of the month of July of the same year.

No mating was observed as in the case of the Soerabaia garden, nor any excessive digging from the part of the female.

As soon as the first young Komodo-lizard made its appearance wholly unexpectedly, the direction of the gardens had the kindness to inform me of the event. Although they were pretty sure that the young animals were really *Varanus komodoensis*, they wanted me to identify the specimens. This was easy enough, the animals showing all the typical features of the adult lizards with only some slight deviations as regards the relative lengths of body and tail.

I wish here to express my thanks to the Direction of the „Vereeniging Planten- en Dierentuin Batavia” for the opportunity they gave me to inspect and measure the young lizards immediately after birth and especially to Mr. W. KOENDERS for allowing me to reproduce his photograph of a young lizard taken some days after birth.

The measurements given in the following table were taken from the live animals. They are not absolutely accurate for the young lizards objected strongly to being touched by human hands, and by no means we were going to hurt them. They are, however, accurate enough for the purpose of showing the differences with the adult animals, where the tail is only slightly if at all longer than head and body.

	mm	mm
length of head and body	210	200
length of tail	285	280
length of the head	45	44
width of the head	22	22

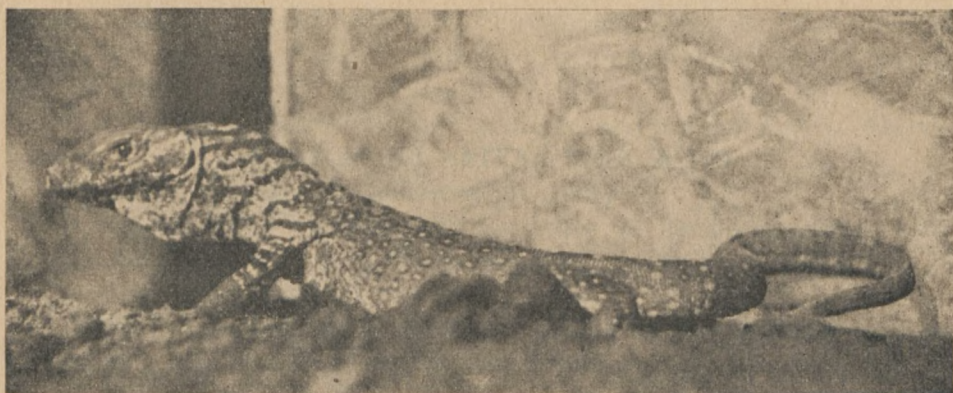
The animals were very aggressive, quite in contrast to the young of *Varanus salvator* LAURENTI. The photo shows one of them in his unfriendly mood, displaying the gular sac in much the same way as do the adults when they meet in the field in the neighbourhood of bait.

It is a well known fact that young specimens of other *Varanus* species are much more brightly coloured than the adult ones, and the same holds true for *Varanus komodoensis*.

In the young the sides of the head are yellowish with a dark smoky horizontal streak running through the eye. There are some blackish vertical bars on the upperlip. The neck is bright yellow or yellowish green, with four or five chevron-shaped black bands on the nape, followed by more black stripes, which reach as far as the shoulder. The forelimbs are black with yellow transverse bands which are broadest near the shoulder. Most of the narrower bands on the lower arm are broken up into yellow dots, covering two or more scales. The hindlimbs are dotted with small whitish specks. The body is dark brown, dotted with numerous ocelli of a dull brick-red colour. These ocelli are arranged in crossbands. This red of the ocelli is of the same hue as the reddish colour that may sometimes be observed on the body of the younger animals.

The tail is banded with alternating narrower and broader transverse bands of a dull yellowish colour. The narrow bands in the anterior part of the tail are broken up into ocelli. The darker brown interspaces which anteriorly are rather broad become narrower towards the tip of the tail.

Of these bright colours hardly anything remains in the adult animals. In the tails one may observe some indications of the transverse bands, exhibiting darker and lighter areas. I never saw the slightest trace of ocelli on the body but the brown brick-red colour is a rather common feature in the middle sized animals especially when they have just left the water, and are not yet covered with mud or dust. The neck in the younger specimens is always of a lighter colour than the rest of the body,



Newly hatched young of *Varanus komodoensis* OUWENS in aggressive pose, showing gular sac.
Photo W. KOENDERS.

sometimes it even might be called greenish-yellow, but in the smallest specimens I ever saw in the field, measuring about 125 cm in length, there was never any trace of the black chevron stripes on the nape. The sides of the head are usually of a lighter colour, even in the older males and yellow markings round the eyes may even be present in very old males.

If we review the known facts concerning the propagation of *Varanus komodoensis*, we find that the mating season falls in the month of July, and that the eggs are laid in the month of August, both facts established in the Soerabaia Zoological garden. The eggs hatch in the month of April, as found in the Batavia garden. So the duration of the egg-stage is eight months.

ON A NEW ACTIAS FROM JAVA

(Lep., Saturniidae)

by

L. J. TOXOPEUS
Buitenzorg, Java.**Actias (Plectopteron HUTTON) selene miae**, subsp. nov.

Description. ♀. *Upperside*, light nile-green, assuming a yellow-green tint near the apex and termen of forewing. Veins sordid white. Costa deep brown edged with chocolate-brown and white, lighter towards the apex, where the brown colour stops abruptly at the origin of the oblique discal band, and then proceeds to the apex as a yellow line edged with reddish. An oblique discal band, 2—3 mm broad, runs from costa at 15 mm proximally from apex, in a slight inward bend, to dorsum at 10 mm from tornus, this band is olive-green in the fresh specimen, rather dark owing to the thin black hairs which cover it (the hairs that cover the surfaces of both wings are white). A barely visible oblique greyish line near base.

Hindwing with a thin olive line from costa at 10 mm inwardly from apex, running parallel with termen to dorsum, crossing the origin of the tail, ending at dorsum as a yellow bunch of thin hairs. The upper part of this line is nearly invisible above. There is a faint yellowish streak near the base. Concave side of tail from its origin to half way its length and the two adjacent veins 3 and 4 covered with big light pink scales of a peculiar form. Bases of both wings woolly and pure white.

Length of tail 65 mm, breadth good 1 cm, slightly spatulate near the end, and strongly frinkled from middle to outer end.

Ocelli small, each consisting of two half moons, separated by the lenticular glassy part. The inner half moon is dark brown, divided by a thin white line, the outer one is white inside and very light pink outside, this red part is broader than the white.

Underside, ground-colour as above, costal area of forewing white as are the veins. Ocellar rings reduced in both wings, a thin light cherry-red line is well visible in the hindwing ocellus only. Olive postdiscal band of forewing runs at 1 cm parallel with termen, that of hindwing is somewhat broader and runs from costa to dorsum parallel with termen (but crossing the tail). No reddish tint at the bend of the tail, but here the yellow colour of the fringe overlaps to vein 4.

Head, thorax and abdomen white as cotton, thorax with a chocolate-

brown transversal band to connect the costal stripes, and a similar half ring above the eyes. From the head to the implantation of the first pair of feet the breast is tobacco-brown.

Feet: femora white, woolly, tibiae and tarsi reddish brown. Valvulae greyish.

Eyes deep blackish brown.

Antennae light brownish (at the base) to light olivegreen. Every long tooth is thickened towards its outer end.

Length of forewing 93 mm.

Type, unique, hatched from a pupa found near the resthouse of Ranoe Daroengan, southern slope of Mt. Semeroe, East Java, June 11, 1941, at 800 m. altitude by Mrs. M. & Mr. M. A. LIEFTINCK.

The description was made after the fresh specimen, one day after its developing to the imago stage. Soon after its emergence at Buitenzorg, on August 21, it escaped and had to be caught in the dar, and so the wing-scales were rubbed off a little.

The egg (drawn from the ovary) is oval, 2.5 mm long, white and green in irregular patches like the seed of *Ricinus*, it is finely punctured like shagreen leather.

The cocoon was found at the foot of a rattan plant, and was spun between the leaves.

This striking new subspecies, which I have the pleasure to name after my friends wife, who accompanies him on his entomological excursions and who captured many a fine specimen new to science, adds a remarkable palaearctic insect to the fauna list of Java. JORDAN' (Seitz II) mentioned the species from Borneo and afterwards described the Andaman subspecies *calandra* (Nov. Zool. 1911), which lacks the pink colour on the upperside of the tail that Indian forms show so nicely. The East Java form therefore recalls these latter continental forms. I have not found any description of the Bornean subspecies.

The specimen before me seems to be very large, in fact it is as large as most Javanese *Actias* (*Sonthonnaxia*) *maenas diana* MAASS & WEYM. Its tail is very long and broad compared to Indian specimens, it measures double that of typical *selene* HBN. as figured by COTES (Ind. Mus. Notes, II, 1891, Pl. IV fig. a)

This fine moth must be very rare in Java. I have one information from Mrs. WALSH, the well-known insect collector formerly living at Soekaboemi, that she once obtained a specimen of it in the mountains of West Java, and rumours of other specimens were brought to me from various sides, but not having seen any specimen, I mistrusted the informations, being well aware of the fact that a layman may easily mix up the two *Actias* species.

Now at last we have proof of its existence in Java and may await further discoveries in the western part of the Malay Archipelago.

SUMMARY BY EDITOR

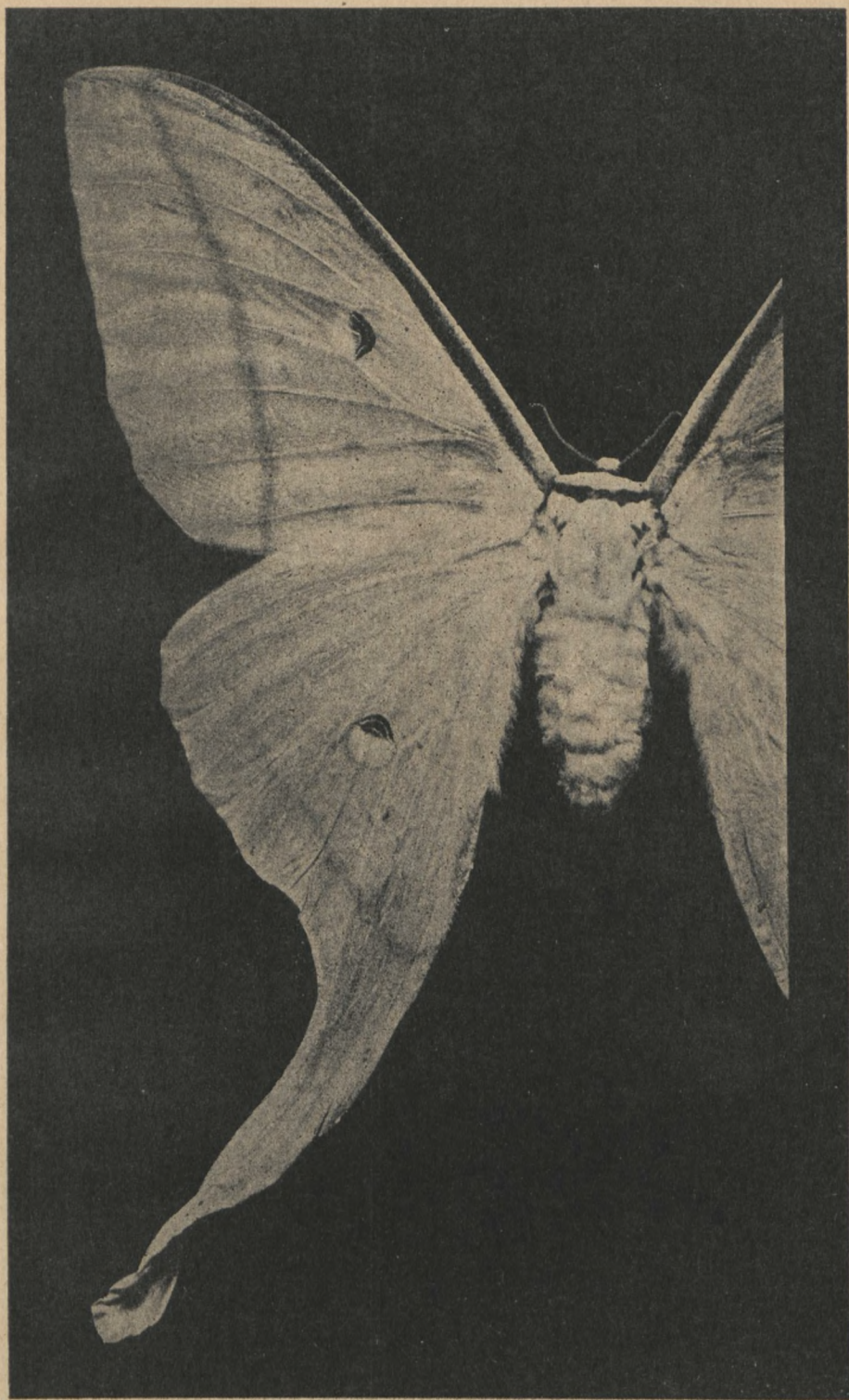
The discovery of a female specimen of this apparently very rare *Actias* was due to Mr. and Mrs. LIEFTINCK of Buitenzorg, who found a cocoon spun between rattan leaves, when they were enjoying a holiday in the resthouse of Ranoe Daroengan, Mt. Semeroe, East Java, in the month of June, 1941.

It was named *Actias (Plectopteron) selene miae*, and extensively described.

It is the largest *selene* from so far known, measuring 93 mm of forewing length. *Actias selene* HBN. is a palaearctic species, which is found in Japan, Formosa, China, India, Ceylon, Andamans and Borneo, therefore E. Java seems to be an outlying post of the species.

By opening the ovary some eggs were drawn out, which were subsequently studied and described.

A plate showing the upper and underside of the insect in photo reproduction accompanies the paper.



Actias selene miae, subsp. n. Upperside $\times \frac{1}{1}$



Actias selene miae, subsp. n, Underside $\times \frac{1}{1}$

THE TAXONOMIC POSITION OF CERVUS KUHLII MÜLL. ET SCHL.

by

A. C. V. VAN BEMMEL
(Zoological Museum, Buitenzorg)

(Plates 45 and 46, text figs. 1-5)

Material

In September 1941 (2601) the complete skeletons and skins belonging to 2 adult male specimens of *Cervus kuhlii* MÜLL. et SCHLEG. were received at the Zoological Museum, Buitenzorg. Both animals had been collected by Mr. W. M. L. VAN DER PAUWERT in the Island Bawean (Java Sea) on request of Dr. J. WESTENBERG, Biologist in the Institute for Seafisheries, Div. Soerabaia. The latter charged himself with the preservation and despatch of the material and Mr. R. MARSAID, Indian Physician on behalf of the Government at Sangkapoera, sectioned and prepared the animals. I beg to tender my best thanks for the considerable trouble these gentlemen have taken to assist me in this matter.

The Museum until then contained little material pertaining to this interesting species. Two trophies were present, the first of the head of an adult male specimen containing complete nasalia (Pl. 45, no. 3), and the second a closely severed head of a young buck having poorly developed antlers (Pl. 45, no. 1). The two specimens had been purchased in 1928 by Dr. K. W. DAMMERMAN at Dipangga (North Bawean). In addition, a cranium of an adult male received from the Zoological Gardens, Soerabaia where it died in 1938 (Pl. 46). Another purchase from Bawean by Dr. K. W. DAMMERMAN are two trophies from very large deer. These, however, definitely do not belong to *C. kuhlii*. One trophy originates from a Sambar and the other from a Java deer. ¹⁾ They were obtained from a village-chief. No information is extant as regards the locality where the two deer had been killed but it may be assumed with certainty that these deer do not occur in Bawean.

¹⁾ CHASEN (Handlist, Bull. Raffles Mus. Singapore, 15, 1940, p. 201) accepts the Java deer as a geographical race of the Sambar. I do not support this view. The difference in antlers, shape of the tail, and especially in the structure of the hair is so large that I feel justified to consider them specifically distinct. I classify the Java deer together with various groups in the eastern part of the Archipelago as subspecies of *Rusa timoriensis* BLAINV. The characters mentioned above are largely similar in these groups.

Aim of the Investigation.

CHASEN (Bull. Raffl. Mus. 15, 1940, p. 202, note) did not decide on the affinity of *Cervus kuhlii*, being: "insufficiently acquainted with this small species to discuss its affinities".

Several authors advocated only a slight affinity of *C. kuhlii* with the other kinds of deer occurring in Indonesia, a view that is at present often accepted. The first to point out the distinct position held by *C. kuhlii* were MÜLLER and SCHLEGEL (Verh. Nat. Gesch. Ned. Overz. Bez. Zool., 1845, p. 209). They observed that, if the classification by HAMILTON-SMITH is accepted, *C. kuhlii* has to be referred to the *Axis*-group as the canine tooth is absent. The structure of the antlers, on the other hand, in their opinion indicates that *C. kuhlii* cannot be satisfactorily placed into the *Axis*-group. SCLATER (P. Z. S. London, 1863, p. 224) referred to the conformity between *Cervus kuhlii* and *C. porcinus* after examining living specimens at the Amsterdam Zoological Gardens (cf. J. E. GRAY, Cat. Rum. Mamm. Br. Mus. 1872, p. 79). BROOKE (P.Z.S. London 1878, p. 902) also indicated a close affinity to *C. porcinus* as regards characters of the cranium. Finally LYDEKKER (Cat. Ung. Mamm. Br. Mus. IV, 1915, p. 62) compiled the relevant literature which unfortunately was not fully at my disposal, and came to the conclusion that a close affinity existed between the subgenus *Hyelaphus* LUNDEVALL and *Cervus kuhlii*. It seems difficult to understand why LYDEKKER keeps *C. kuhlii* in the genus *Rusa*. Not only a distinct and separate position is assigned to the species (l.c. p. 61) but he also indicates the „glandular cleft in the hind-pasterns". In accordance with POCK (P.Z.S. London 1910, p. 948) he accepts these as a characteristic of the genus *Axis* and one would expect LYDEKKER to relegate *C. kuhlii* to the genus *Axis*.

Recently ERNA MOHR (Arch. f. Naturgesch. Berlin, LXXXIV, A9, p. 109) referred *C. kuhlii* to the subgenus *Hyelaphus*.¹⁾

It appears that POCK who first had recommended the division of the genus *Axis* into the subgenera *Axis* and *Hyelaphus* (P.Z.S. London 1910, p. 950) in the light of subsequent investigations changed his opinion as regards the desirability of this subdivision (P.Z.S. London 1923, p. 185, id. 1933, 950). Yet he again discussed the possibility of maintaining this subdivision (P.Z.S. London 1935, p. 184). I do not venture to express an opinion as the range of material of species in the genus *Axis* I have been able to examine is too small.

The outcome of the present study is that *Cervus kuhlii* should be placed in the genus *Axis* and not in the genus *Rusa*.

In case the subgenus *Hyelaphus* is accepted *C. kuhlii* should be referred to it. A few not yet described taxonomic characters have been added.

¹⁾ The original paper was not procurable but by courtesy of Mr. H. J. V. SODY I have been able to consult an abstract.

Axis (Hyelaphus?) kuhlii (MÜLL. et SCHLEG.)

Cervus kuhlii MÜLLER et. SCHLEGEL, in TEMMINCK, Verh. Nat. Gesch. Ned. Overz. Bezitt., 1845, p. 223, tab. 44 and 45 fig. 12 — 14 (terra typica: Island Bawean).

Taxonomy

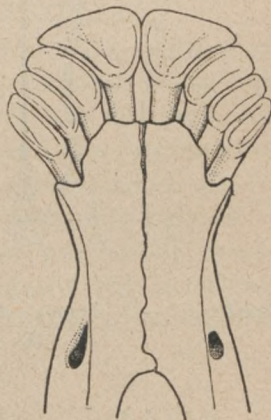
1. *Teeth*. The canine-teeth in the upper jaw are always absent. In the genus *Rusa* these are always present. The median incisors of the lower jaw are enlarged and exceed as regards width the total width of the three other teeth (cf. text fig. 1). This latter character is a characteristic in the genus *Axis* (POCOCK, P.Z.S. London, 1935, p. 184 and textfig. 4).

2. *Antlers*. The primary branch is long. It diminishes in length in proportion with a more composite system of antlers. These have been pictured on plates 45 and 46.

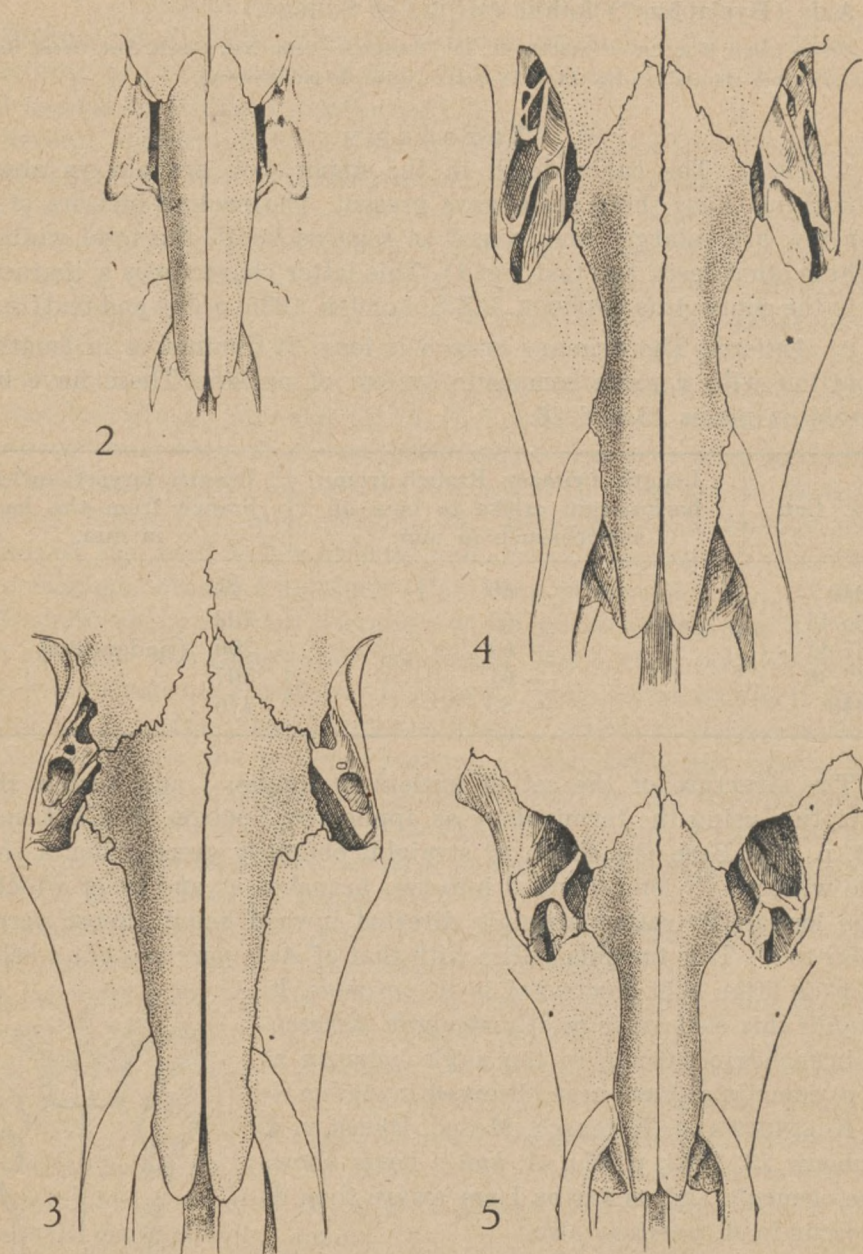
No. Cat.	Length Primary Branch from backmargin orbita to base of antlerbranch in mm.	Length largest antler-branch from the base in mm.
1849	± 69	25
156/41	± 67	208
157/41	± 61	306 (rindantlers)
237/38	± 61	307
1848	± 55	376

The structure of the set of antlers is simple. I add here a short description using the terminology as applied by POCOCK (P.Z.S. London, 1933, p. 38). Base (b) short, a¹ straight, obliquely erect under a sharp angle with p¹. P¹ long, divided into two branches a² and p² of which a² is the longer. P² rather strongly directed inward being almost perpendicular to a². This formula tallies with that of *Axis porcinus* but I believe that p² is often bent downward in *A. porcinus*. In *A. kuhlii* this element is mostly straight. Accessorial branches occurring in the angle between a¹ and p¹ sometimes have been observed in *Axis axis* (cf. KOENIGSWALD, Wetensch. Meded. Dienst v. d. Mijnbouw 23, 1933, p. 67). *A. kuhlii* never shows these elements and as far as I am aware they do not occur in *A. porcinus* also.

3. *The cranium*. The cranium is short. The condylo-basal length hardly is twice the greatest width. In *Rusa* the former is always more than twice the latter. The nasalia are straight and vaulted, the caudal margin being rounded. In *Rusa* the nasalia together form a rhomb, are much less vaulted and the caudal margin is not rounded



Text fig. 1.
Axis kuhlii (Müll. & Schleg.)
Lower jaw. Enlarged.



Textfigs. 2—5. Nasalia of *Axis kuhlii* (2), *Rusa unicolor equinus* (3), *Rusa timoriensis russa* (4), and *R. t. timoriensis* (5). $3/5 \times$ natural size.

(fig. 2). The bullae auditoriae are large and bulging similar to *Axis porcinus*. The cavity of the preorbital glands is shallow. In *Rusa* this cavity is very deep.

4. *Hairs*. The hairs are short and soft, yellow and brown ringed and thus are widely different from those in the genus *Rusa*. The colour has been perfectly described by MÜLLER and SCHLEGEL. The coloured picture they give is excellent though perhaps very slightly too dark. Especially the tail is somewhat more ruddy, and the belly has less white. No mane is present. Dappling does not occur, not even in the young (cf. SCLATER l.c.).

5. *Habit*. The shoulder-height in our specimens is approximately 65 cm and therefore is nearly the same as in *A. porcinus*. The animal is much lighter built. Plate 46, fig. 2 illustrates this clearly. MÜLLER and SCHLEGEL's plate shows the build much too high. Actually the tail is much shorter and is similar to that in *Axis axis*.

6. *Olfactory glands*. The preorbital glands are smaller than in *Rusa* and shallow (cf. sub 3). The metatarsal gland is represented by a glabrous, horny, smooth, darkly coloured, ovate patch of skin exactly alike to that described in *Axis* by POCKOCK (P.Z.S. London 1910, p. 948, fig. 132 E). This spot is surrounded by a zone of long hairs covering the glandular patch entirely. The pedal gland in the hind legs is well developed and deep. The inside carries long hairs which protrude. The base has been coloured yellow by the substance secreted and is often clinging together with adjoining hairs. These types of glands are characteristic in the genus *Axis* (POCKOCK, P.Z.S. London 1910, p. 948-950 and id. 1923, p. 185).

Affinity of *A. kuhlii* to recent species.

It has been demonstrated that *A. kuhlii* may be placed with certainty in the genus *Axis* in the sense of POCKOCK (P.Z.S. 1923, p. 67).

If it ultimately proves to be desirable to subdivide the genus *Axis* into two subgenera, then *A. kuhlii* will have to be relegated to the sub-genus *Hyelaphus* due to the characters of the antlers, the low build and the plain not dappled colour of the hide. There exists a close relationship between *A. porcinus* and *A. kuhlii*. Perhaps *Axis calamianensis* HEUDE (terra typica: Calamianes Arch.) will prove to be closely related. A further investigation into the species of the genus *Ussa* HEUDE is also required. These are much similar to *Axis* as regards the incisiform teeth (POCKOCK, P.Z.S. London, 1935, p. 186). Unfortunately no material is at my disposal to form an opinion.

Affinity of *A. kuhlii* to fossil species

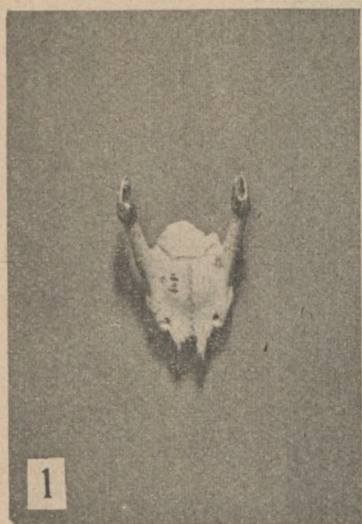
The close relationship between the fossil species *Cervus (Rusa) oppenoorthii* v. KOENIGSWALD and *A. kuhlii* has been pointed out by

C.H.R. v. KOENIGSWALD (Beitrag zur Kenntnis der fossilen Wirbeltiere Javas, I, Wetensch. Meded. Dienst v. d. Mijnbouw, No. 23, 1933, p. 76-77, Taf. XXII, 7 and 8). A fragment of the cranium together with a moderately well preserved set of antlers belonging to *C. oppenoorthii* have been discovered in Java near Semboengan in young pleistocene sediments. An antler-branch from Pitoe, Java, found in similar sediments tentatively is referred to this species by v. KOENIGSWALD (cf. also v. KOENIGSWALD: Quartär, Berlin, 2, 1939, p. 45).

As to its structure the set of antlers of *Cervus oppenoorthii* fully agrees to that in *A. kuhlii* but it measures larger and relatively spreads much wider. Admittedly v. KOENIGSWALD refers *C. oppenoorthii* to the genus *Rusa* but the fossil rests do not show any of the characters essential to distinguish between the genera *Rusa* and *Axis* with the exception of the antlers and rather long primary branch. In my opinion there is no reason not to reduce *C. oppenoorthii* to the genus *Axis*. V. KOENIGSWALD's contention that the smaller measurements in *A. kuhlii* are due to the degenerating influence of insular life seems likely to be correct (l.c. p. 77 and 84). I even believe that probably *C. oppenoorthii* should be classified as a fossil subspecies of *A. kuhlii*. The former in that case might be indicated as *Axis kuhlii oppenoorthii* (v. KOENIGSWALD).

Zoogeography

Axis kuhlii as occurring in Bawean seems a relict. Perhaps this species reached Bawean in the Diluvial period at the time that the Sunda Plateau still was above the surface of the sea (v. KOENIGSWALD, Wetensch. Meded. Dienst v. d. Mijnbouw 23, 1933, p. 84). The finding of fossil rests of *C. oppenoorthii* in Java would support this view. There is a possibility that *A. kuhlii* reached Bawean by way of the Celebes-bridge from the Philippines. This possibility would seem more probable if a more close relationship between the Philippine species and *A. kuhlii* could be demonstrated to exist than between *A. kuhlii* and *A. porcinus*. The migration of *Axis axis* from the continent by way of the Sunda Plateau to Java has been proved by the discovery of a fossil race of this species as described by v. KOENIGSWALD (l.c. p. 65 ff. sub *Axis axis javanicus*). Perhaps the same route was taken by the ancestors of *A. kuhlii*. The ancestral form on the continent would have to be regarded as being extinct, or *A. porcinus* would be the original form. As yet it seems not sufficiently supported by the facts to consider *A. kuhlii* and *C. oppenoorthii* as geographic representants of *A. porcinus*.



1 — 4 *Axis kuhlii* (Müll. et Schleg.) ♂ Skulls present in the Zoological Museum, Buitenzorg.
 1. no. 1849, 2. no. 157/41; 156/41, 3. no. 1848, 4. no. 156/41.



Axis kuhlii (Müll. et Schleg). ♂ Specimen of the Soerabaia Zoological Garden,
1. Skull, now in the Zoological Museum, Buitenzorg. 2. During life (photo Sody)

SUMMARY BY EDITOR

On occasion of the receipt of two skins and skeletons of this species, an inquiry was made concerning its systematic relationship. Besides the Museum possesses a skull and two trophies.

MÜLLER and SCHLEGEL placed the species in *Cervus*, basing this opinion on the structure of the antlers, though the absence of the canine tooth pointed to *Axis*. SCLATER and BROOKE referred to the conformity with *C. porcinus*. LYDEKKER thought the species to be allied to *Hyelaphus*, though he placed it in *Rusa*. E. MOHR placed it in *Cervus*, subgenus *Hyelaphus*, POCK in *Axis*. The outcome of the present study is that *kuhlii* should be placed in *Axis*. The following taxonomic characters are given:

1. Teeth. Canine-teeth absent; much enlarged median incisors.
2. Antlers. Primary branch long, diminishing in length in proportion with a more composite system of antlers. Structure simple, generally tallying *Axis porcinus*.
3. Skull. Short. Nasalia straight and vaulted and the caudal margin not rounded. Bullae large and bulging; cavity of preorbital glands shallow.
4. Hairs. Short and soft. No dappling in the young.
5. Habit. Shoulder-height about 65 cm.
6. Olfactory glands. Preorbital glands smaller than in *Rusa*. Metatarsal and pedal glands like in *Axis*.

It is demonstrated that indeed *kuhlii* must be placed in *Axis* (subgenus *Hyelaphus*, if subdivision is desired). The species shows much resemblance to *A. porcinus*. It may prove to be closely allied to *A. calamianensis*.

The fossil *Cervus (Rusa) oppenoorthii* from Java, described by VON KOENIGSWALD as being closely related to *A. kuhlii*, may also be reduced to *Axis*. Perhaps it is a subspecies of *A. kuhlii*.

A. kuhlii, as occurring in Bawean, seems a relict. It may have reached the island from the Sunda Plateau, or from the Philippines by the way of the Celebes-bridge.

RESULTS OF THE ARCHBOLD EXPEDITION TO NEW GUINEA

Lepidoptera: Riodinidae (Erycinidae)

by

L. J. TOXOPEUS

Buitenzorg, Java.

The Archbold collection of *Riodinidae* contains twelve species and was brought together between Humboldt Bay and Mt. Wilhelmina in central New Guinea, no specimens of this family being caught on the way onward or back home.

It consists of eight species of the purely Papuan genus *Dicallaneura* BTL., and four of the likewise geographically restricted genus *Sospita* HEW. (= *Praetaxila* FRUHST.), and these form the main object of the present paper. Besides the eight ARCHBOLD species I had two other *Dicallaneura* species at my disposal, one from Schouten Is. (*D. princessa* GR. SM.), which I received from the late Dutch lepidopterologist Mr. P. J. VAN DEN BERGH, and one from Hollandia, which I found in the Buitenzorg Zoological Museum. There were also two other *Sospita* species represented in that museum.

At least six species out of thirteen of the genus *Dicallaneura* already described from New Guinea, I had no access to, and the number of *Sospita*'s that I could not study in natura was four on a total of eleven species.

All *Riodinidae* are rare in collections. In the field they are not frequently seen on the wing and I noticed some species usually not appearing before 4 p.m. At that time of the day specimens were seen playing and basking on the sunlit leaves of tree branches overhanging a small river-bed near Hollandia. The mountain species were mostly caught on visiting flowers, and nearly always in the afternoon. So the dry season is the best collecting time for New Guinea Erycinids, as wet monsoon afternoon showers will usually interfere with their normal habits.

Most species of *Dicallaneura* and *Sospita* are discoveries of the last fifty years, and before 1894 only a single species of each was known from the mainland of New Guinea: the earlier known forms being mostly discovered in adjacent islands. With a better knowledge of the interior one after the other got known, and in 1914 FRUHSTORFER was able to revise seventeen New Guinea species and to describe a number of

subspecies, mainly based on the rich collections of the British Museum and Tring, which monography was published in „Seitz”.

STICHEL gave a new revision in „Tierreich” (1928). I could not get this publication, but the results have been issued again in STRAND's *Lepidopterorum Catalogus* XL, 1930, by the same author.

After FRUHSTORFER, JOICEY and his collaborators added some new species and subspecies to the list on describing the fine captures of Messrs. PRATT in the Arfak Mts. of Vogelkop Peninsula, Wandammen Mts. and Weyland Mts. (S. of Geelvink Bay), in the Transactions of 1915, the Annals of 1916 and the Hill Museum Bulletin of 1922. No new additions have come to the Erycinid fauna list of New Guinea since then, with the exception of two subspecies, i.e. *Sospita (Praetaxila) weiskei huonis* JORD. 1930 and *Dicallaneura kirschi pelidna* JORD. 1937; the latter of which, however, should be considered as a valid species.

In the following, three new species and four new subspecies of *Dicallaneura* will be described, and five new subspecies of *Sospita*, besides the hitherto undescribed sex of three *Dicallaneura* species and subspecies. The material studied belongs to the Buitenzorg Museum, but some specimens were in the possession of the Leiden Museum (collected by Dr. H. BOSCHMA during the LE ROUX Expedition to the Wissel Lakes in S.W. New Guinea) and others were in my private collection. I have included these, their descriptions are printed in small type, and put in brackets if not belonging to species of our own captures.

The itinery of our expedition and a map were given in Treubia 1941.

I. *Dicallaneura* BTL. 1867.

A. *Species with the innermost submarginal light band of the hindwing broken up into separate spots.*

Two species belong to this group: *D. decorata* HEW. and *D. ekeikei* BETH.-B. ¹⁾

1. *Dicallaneura decorata* HEW. 1861.

Taxila decorata, HEWITSON, Ex. Butt. III, 1861, *Taxila* t. 2, f. 11 —13(Aroe Is.); *Dicallaneura decorata* HEW., BUTLER, Proc. Zool. Soc. 1867, p. 38, f. 1 (id.); *D. decorata* HEW., FRUHSTORFER 1914, STICHEL 1928, 1930 a.o.

OBERTHÜR, though one of the most critical authors of the past century, linked *D. decorata* as a synonym to *D. leosida* BSD., in stead of fusing it with *pulchra* GUÉR. In view of the fact that OBERTHÜR had access to the types of BOISDUVAL and GUÉRIN-MÉNEVILLE, it is difficult to understand how this error may have arisen, for BOISDUVAL himself,

1) *D. ekeikei ekeikei* BETH.-B. 1904 (Ekeikei, 1500, near Angabunga R., N. of Port Moresby, Br. New Guinea). *D. ekeikei longifascia* JOIC. and TALB. 1922 (Nomnagihé, 25 miles S. of Wangar, S. Geelvink Bay, 2000', Neth. New Guinea).

in describing *Emesis* *Leosida*, declares it synonymous with *Argynnis* *pulchra* GUÉR., and his description of the ♀ *leosida* fits in every detail to the ♀ *pulchra* from W. New Guinea. This will be discussed hereafter more extensively.

The species *D. decorata* HEW. is the commonest *Dicallaneura* of New Guinea and surrounding islands. The following subspecies are to be registered:

a. *D. decorata decorata* HEW. 1861.

Taxila decorata, HEWITSON l. c. (Aroe Is.); *Dicallaneura decorata* HEW., BUTLER l. c. (id.); *D. decorata decorata* HEW., FRUHSTORFER, Iris 1904, p. 147 (id.); id. in Seitz IX, 1914, p. 787; id., STICHEL in Tierreich LI, 1928, p. 111, f. 80; id. in Lep. Cat. XL, 1930, p. 116.

One pair in the Buitenzorg Museum (acq. Mrs. WALSH, Dobo 1931).

This subspecies is extremely near to *sfagia* FRUHST. from S. W. Neth. New Guinea and differs in the male sex in having a lighter and broader forewing band. The females of both subspecies hardly show any difference at all.

b. *D. decorata sangha* FRUHST. 1914

Misool.

c. *D. decorata adulatrix* FRUHST. 1904

Waigeo.

d. *D. decorata tantra* FRUHST. 1914

Taxila decorata, var., HEWITSON, J. Linn. Soc. 1865; *Dicallaneura leosida*, OBERTHÜR (nec BOISD.), Ann. Mus. Civ. Gen. 1880, p. 527 (Andai, near Manokwari); *D. decorata tantra*, FRUHSTORFER in Seitz IX, 1914, p. 788 (type: Dorey = Manokwari; ? Kapaur); id., STICHEL 1928, l. c., p. 112, and 1930, l. c., p. 116 (Neth. New Guinea: Geelvink Bay).

2 ♂, 2 ♀, Manokwari district 1929, acq. VAN DEN BERGH (coll. TOXOPEUS). ♂. Fits to FRUHSTORFER's short description.

♀. Yellowish ochre above, but outer edge of yellow area of forewing and also hindwing more orange. Hindwing with well-developed submarginal black marks but with little grey suffusion; the round spot of the lobe surrounded by an orange ring. Underside: distal half of forewing chestnut, apical border orange, which colour fades away towards vein 3. Hindwing orange with light brown and white markings, all spots relatively small; lobal black spot small but well ringed with silver.

Plesiotype ♂ and neallotype, with the three paratypes, in coll. TOXOPEUS.

This subspecies is remarkable in the male sex by its narrow but clear orange-brown forewing band, and the vivid rusty-brown hindwing, which shows nearly no darkening inwardly, but a clear yellow costal-apical area. The underside is even lighter than with *ostrina* Gr.-Sm. and the brown mottlings of the hindwing are scarcely any darker than the ground-colour.

The locality Kapaur (Onin Peninsula), given by FRUHSTORFER as a further habitat of this subspecies, seems doubtful; moreover FRUHSTORFER himself records differential points of Kapaur specimens.

e. *D. decorata sfagia* FRUHST. 1914

D. decorata sfagia, FRUHSTORFER, l. c., 1914, p. 788 (type: Eilanden R., S. W. Neth. New Guinea; Octakwa R. 1100 m — alt. an recte? —); *D. conos*, RÖBER (nec FRUHSTORFER), Nova Guinea XIII, Zool., 1915, p. 49 (Van Weelskamp, at bifurcation of Lorentz R.-Reiger R.); *D. decorata tantra*, ROTHSCILD (nec Fruhst.), in Woll. Exp. II, 1916, p. 26 (Octakwa R.); *D. decorata sfagia* FRUHST., STICHEL ls. cs.

1 ♂, 2 ♀, Kaimana, S. W. Neth. New Guinea, near the mouth of Argoeni Bay, 2. VIII. 1941 (LUNDQUIST and 2 ♀, S. (Neth.) New Guinea 1911 (DENIN), in Museum Buitenzorg.

The ♂ agrees in every detail with FRUHSTORFER's diagnosis, but the fig. in SEITZ (140e, ♂) shows the forewing band too sharp and too light.

It may be esteemed very remarkable that so extremely far to the west (the Kaimana Bay is due S. of Manokwari) a subspecies of mid-south affinities occurs unchanged. This runs parallel however, to the geographical distribution of *Danaus affinis* F. The ♀♀ from Kaimana are more heavily white-spotted than the two old museum specimens from uncertain localities.

The latters were incorporated in the museum collection as *Abisara conos* ♂ (!).

Specimens from the Fly R. mouth ¹⁾ probably belong to this subspecies.

f. *D. decorata parina* FRUHST. 1914

Taxila decorata HEW., TRYON Ann. Rep. Brit. New Guinea 1889—1890, App. V, p. 115 (Apiana, st. Joseph R. Distr.); *D. decorata parina*, FRUHSTORFER, l. c., p. 788 (♂: Aroa R. ± 700 m); *D. decorata sigala*, FRUHSTORFER, l. c. (partim; ♀ type: Yule Isl.).

Yule Isl. (Kairuku) lies at the mouth of St. Joseph R., at not quite 20 miles from the topotypical habitat of *parina*. FRUHSTORFER must have been unconscious of this geographical fact, for otherwise he would certainly not have mixed up *sigala* ♀ with a ♂ type from Milne Bay and with other specimens from Kumusi R., N. of Owen Stanley Range.

In most species there is a marked difference between southern and northern Papuan forms and I think it therefore illogical to entirely contract *parina* and *sigala*, as does Dr. STICHEL.

g. *D. decorata sigala* FRUHST. 1914 (= *sariba* FRUHST. 1914)

Milne Bay (♂: type); Sariba Isl. ²⁾, Kumusi R. ♀ undescribed.

h. *D. decorata conos* FRUHST. 1904

'German' New Guinea.

♂. Near to *ostrina* GR. SM., but the basal third of forewing is dark reddish-brown instead of dark brown as in the latter.

♀. Nearly identical to *ostrina* ♀.

FRUHSTORFER seems to have described specimens from Astrolabe Bay, whence HAGEN had sent him a series (HAGEN: Jahrb. Nassau. Ver. Naturk. L, 1897, p. 96: *D. decorata* HEW.). The latter author did not mention Huon Gulf, where *decorata* may have assumed another form and will be nearer to that of Kumusi R., to my opinion.

i. *D. decorata ostrina* GR. SM. 1894.

D. decorata HEW., GROSE SMITH, Nov. Zool. I, 1894, p. 543, no. 172 (Humboldt Bay); *D. ostrina*, GROSE SMITH, l. c., no. 173 (♂, id.): id., GROSE SMITH and KIRBY, Rhop. Ex. II, 1897, Dic. & Abis. I, f. 1, 2 (♂), p. 1 (id.); *D. decorata ostrina* GR. SM., FRUHSTORFER, Iris 1904, p. 147; *D. ostrina ostrina* GR. SM., FRUHSTORFER in Seitz IX, 1914, p. 788: id., STICHEL in Tierreich LI, 1928, p. 109; id. in STRAND, Lep. Cat. XL, 1930, p. 114.

5 ♂, 2 ♀, Hollandia VI—VII. 1938.

FRUHSTORFER was the only author who, in 1904, spotted the real nature of *ostrina* GR. SM., but in 1914, probably after having seen type specimens in the Tring Museum, he kept *ostrina* separate from *decorata* again.

My series from Hollandia, containing ♂♂ and ♀♀ collected at exactly the same spot, allows me, after a close examination of many *Dicallaneura* species and subspecies, to conclude that *ostrina* is only a subspecies of *decorata* HEW.

The male sex has undergone a darkening process, which manifests itself mostly on the upperside. Traces of the reddish band are still found on the lower discocellulars and the median nervules in fresh specimens,

1) TRYON, vide sub f. (Fly R.)

2) Sariba Isl. lies before the entrance of Milne Bay, next to Samarai.

and one of my captures from *Araucaria* R. (see below) shows a short reddish-brown band.

The underside of the ♂ is darker than in *D. decorata tantra* FRUHST. from Manokwari, but lighter than in *D. decorata decorata* HEW., so I am at a loss as to what may have been the form of *decorata* which served as the object for comparison to GROSE SMITH (see above), if this has not been the ♀ of his own *ostrina* (which he obviously identified as true *decorata*).

This *ostrina*-♀ differs from the same sex of *decorata tantra* in the tornal parts of the hindwing upperside being darkish, so that no yellow ring encircles the black lobal spot (compare diagnosis of *tantra*-♀ above). On the underside the apical orange bordering of the forewing is much reduced and the brown mottlings of the hindwing are a darker shade.

SEITZ' picture of *ostrina*-♀ underside is that of a ♂ (t. 140d), and it shows the ground-colour too dark. It is better, though, than GROSE SMITH and KIRBY's ♂ underside drawing, which has the base of the forewing blackish-brown instead of vivid brown, the submarginal white line from apex to tornus continuous instead of broken at the veins and, above vein 3, also at the fold between the veins; further the silvery-white streaks in the anal part are miscoloured dull orange-yellow in the figure, and the other whitish markings, including those of the forewing, are too sharply defined.

Plesiotype (♂), neallotype, together with 3 ♂♂ and 1 ♀ paratype in the Buitenzorg Museum; 1 ♂ paratype in the National Museum, New York.

j. *D. decorata kausambides* n. subspec.

2 ♂, *Araucaria* R., 800 m, 24. III, and 700 m, 31. III. 1939

♂. - *Upperside*: differs from *ostrina* GR. SM., to which it seems to be most nearly related, in the hindwing being devoid of the reddish-brown colour at the apical border, which is replaced by a dull greyish-yellow.

Underside: base of forewing darker brown, apical and marginal orange colour still further reduced, grey dorsal area extends nearly to vein 2. Hindwing ground-colour dull light brown, mottlings dull chocolate-brown.

♀. Unknown.

Holotype (the specimen caught at 800 m) and paratype in Museum Buitenzorg.

ab. *intermedia* nov.

1 ♂, *Araucaria* R., 800 m, 10.III.1939.

Upperside: a short reddish-brown band in the corner between the lower discocellulars and vein 2 of the forewing, and a reddish-brown area upwards from vein 5 of the hindwing, which changes its colour to reddish-yellow near the costa.

Underside: like *kausambides*, but the ground-colour somewhat lighter.

Holotype in Museum Buitenzorg.

I had, to my regret, no Idenburg R. specimens to compare with the nearby mountain form from Araucaria R. Notwithstanding this, I entertain no doubt that my new subspecies *kausambides* is one of those isolated coastal forms which were subdued to the rapid terrestrial elevation which followed the rise of the Snow Mountain range. Quite a number of these low-land species were discovered in the sheltered valleys S. of Idenburg R., some of them even reaching an altitude of 1600 m.

Some of these species have undergone such changes of outlook to render it difficult to trace their parentage. In a few cases, such as here, an archaic form was discovered amongst the greatly altered general form, and this was the rule with species whereof we captured a long series of individuals. Such 'commonly' looking specimens may be strays from the adjacent lower valleys (though it is many miles if they follow the valley up-river) or the offsprings of such. I have treated these as aberrations, but in some cases it would be better to consider them products of Mendelian splittings. The above-described *intermedia* may therefore be the common of the Meervlakte, or a mere atavistic aberration. I think it worth naming it though, because it constitutes a link between the bandless subspecies *ostrina* or *kausambides* and the normal banded *decorata* forms. The red triangle of the hindwing is a character not met with in any *decorata* subspecies and this makes the form the more interesting.

There is an unmistakable similarity between the three subspecies *conos* FRUHST., *ostrina* GR. SM. and *kausambides* m. The darkening of the ♂ upper surface which sets in at Astrolabe Bay reaches its maximum at Araucaria R.

k. *D. decorata ansuna* FRUHST. 1914

Dicallaneura decorata HEW. KIRSCH, Mitth. Mus. Dresden, II, 1877, p. 126 (Ansus, Jobi Isl.); *D. ostrina ansuna*, FRUHSTORFER, l. c., p. 788, t. 140d (partim: ♀ nec ♂ = *pulchra* subsp. Jobi or Jappen Isl., Geelvink Bay): id., STICHEL, l. c., 1928, p. 109; id., 1930, p. 114.

This is a miscreation of FRUHSTORFER's, who coupled a ♂ of a *D. pulchra* subspecies with a ♀ of *decorata*. The latter was depicted first, and as no recognizable characteristics of any sex were added in the text, and because STICHEL has fixed already this *ansuna* as the Jobi form of *decorata*; we have to retain the name *ansuna* for the *decorata* subspecies of that island.

Whether this is related to the Vogelkop subspecies *tantra* FRUHST. or to *ostrina* GR. SM. from Humboldt Bay may get decided at the moment of the discovery of the male sex, or rather, after the capture of a good long series.

Some zoogeographical notes on the species *Dicallaneura decorata* HEW.

The relative commonness of *D. decorata* and its susceptibility to local influences enables us to draw some conclusions regarding the zoogeography of this insect.

We already confronted the subspecies *conos*, *ostrina* and *kausambides* (see above). These constitute a natural group, together with which three

other groups of equal value can be put aside. If we name the first group the *ostrina* section the others may be designated as the *tantra* section, the *decorata* section and the *parina* section.

As we have seen, the *ostrina* section is characterized by its dark ♂ having a relatively light hindwing underside.

The *decorata* section has a banded ♂ and a very dark underside, it comprises onymotypical Aroe Is. *decorata*, the S. New Guinea subspecies *sfagia* FRUHST. and probably the Fly R. subspecies (if the latter is really a separate subspecies).

The *tantra* and *parina* sections are superficially very alike. The former is known with certainty from Waigeo and Vogelkop Peninsula, the latter inhabits British New Guinea from Yule Isl. to Kumusi R. and probably ranges as far as Huon Gulf. Both display a reddish band in the ♂ sex together with a light underside and the ♀ is exceedingly light below. So far as I see it, the *tantra* section consists of large forms on the average and the *parina* section of smaller forms.

Such resemblance like that of *tantra* and *parina* stands not alone. It is an example again of the wide-spread superficial similarity of far-western and far-eastern New Guinea representatives of one species. The same phenomenon is found back in every family of butterflies and has sometimes misled authors to the erroneous conclusion that W. and E. New Guinea are inhabited by a certain species but the intermediate part by one or more other species, whereas at close examination all prove to be forms of only one species.

I may recall here a most instructive case of this repetition of a similar form after a great jump, in the Butterfly family *Danaidae*: I mean the case of *Danaus affinis* F. This insect flies along the western shores of Geelvink Bay in the dark *mytilene* cloth; the northern plains and coasts are inhabited by fulvous *bonguensis*, the southern side of Snow Mts. by the very variegated *affinis* group (with Australian affinities), and far-eastern New Guinea with adjacent islands by dark subspecies again, which gather round *ferruginea*. *D. bonguensis* FRUHST. and *D. affinis* from the opposite parts of the Snow Mts. are most contrasting and both differ greatly from *mytilene* FELD. in the W. and *ferruginea* BTL. in the E., but the latter two have brought forth local forms of so striking a similarity that FRUHSTORFER e.g. described as a *mytilene* subspecies the local form of the Solomon Is., which certainly belongs to the *ferruginea* compound and lives at a distance of thousands of miles from the real *mytilene* stock. On the reverse the same author added *jobiensis* GR. SM. to *ferruginea*, which two are separated by the whole bulk of New Guinea.

In other groups of the animal kingdom, e.g. *Odonata* (Dragonflies) and birds the same observation was repeatedly made.

Where there is any repeating of a fact which looks like a rule there must be a causality. Assuming the preposition that the stated similarity of outward aspect is not merely phaenotypical but a result of real hereditary relationship, the mid-New Guinea forms then must have had, as a matter of fact, another line of descent or other ancestors.

It looks (by the similar outlook of its inhabitants) as though East and West have been one stretch of land during a long time, and such till quite recently, and that North and South, although inhabited by a nearly related fauna, were separated during all that time. The latter faunas have absolutely the aspect of what we are used to call „insular”. These faunas must have assumed a special exterior (and presumably interior aspect too) as a result of long isolation and shifting, before their areas were linked to the headland by geological processes.

When we look round for a similar instance in the Indo-Australian Archipelago we do not find a quite identical one, but we can construct a case which has perhaps been similar in the glacial period.

If Borneo, the Malay Peninsula and Sumatra would now grow into one, at one side with Java and at the other side with Burmah and North India, but get separated from the remainder of India, we would stand before a theme which looks much the same as New Guinea does now. Many species of butterflies and other insects show a striking similarity of aspect in N.E. India and Java, whereas the intermediate subspecies of Sumatra, Borneo and often Malacca are widely different from those.

The geology has not yet given a clue to this India-Java problem, as far as I know, but we have some hold on New Guinea thanks to the geological investigations made by FEUILLETEAU DE BRUYN ¹⁾.

After this author the Snow Mountains are a recent upheaval, dating no earlier than the pleistocene. The land in the vicinity was lifted, the more remote parts, following the law of isostasy, got drowned. The range itself emerged from out the sea, but islands already existing N. and S. of it may have been lifted.

In the South, Australian forms that may have lived on islands far off the Australian mainland, may have spread over the newly emerged plains, but others will have perished. On the other hand, Papuic species that had been subjected to the insular circumstances during a long period and will have assumed the insular characters, were now coming into the most favourable conditions to enlarge their areas.

The same way have happened in the North, although we have scanty information regarding a continent or vast mass of land which should

¹⁾ W. K. H. FEUILLETEAU DE BRUYN „Contr. à la Géol. de la Nouv. Guinée”, Bull. 30 Lab. Géol. Univ. Lausanne, 1921, diss.

have acted as a counterbalance to Australia. The island nature of some parts is, however, obvious ¹⁾.

Such can have been the processes which bore the puzzling facts we have to try to unravel. In short these facts may be recalled here:

1°. the occurrence of Australian species or subspecies in some parts of S. New Guinea, whereas the opposite coast does not show a trace of Papuic forms; ²⁾

2°. the great dissimilarity of the intermediately living subspecies of New Guinea against the obvious proximity of the far-eastern and far-western representatives of the same species;

3°. the occurrence of local forms in enclaves in N. New Guinea, as a kind of initial endemisms.

How does *D. decorata* behave itself in this respect; does it follow the given rules?

There are no *Dicallaneura* species in Australia, so the first question drops. As to the others we can answer in the affirmative, as we see clearly demonstrated the individuality of the northern and southern sections against the uniformity of the eastern and western ones (sub 2°.), and further a marked selfhood of a form which inhabits a mountain massive near an immense plain (the *Araucaria* R. subspecies *kausambides*) -- probably originally an isolated island form (sub 3°.) —.

Some subspecies of *Dicallaneura decorata* I had to omit from the above test, because too little is known of them as yet (no or insufficient data being found in literature), and because I had no specimens of them. The Mysool and Jobi subspecies (*sangha*, *ansuna*) have therefore not been included.

There are a number of most interesting forms still awaiting discovery or further investigation, as the subspecies which doubtlessly will be found to occur in the coastal districts of the western parts of Vogelkop Peninsula, S. Geelvink Bay ³⁾ and Mamberamo R., the islands of Salawati and Batanta, and the Onin Peninsula in the West, Huon Gulf surroundings and Papua Gulf coasts in the East of New Guinea.

B. *Species with the innermost submarginal light band of the hind-wing being a continuous regularly bent or slightly wavy thick line.*

¹⁾ It is not necessary to derive the similarity of E. and W. from the recent existence of an unbroken landmass; for if two large land masses existing under the same conditions are populated with fauna elements which were originally the same, the faunal changes in course of time remain little, whereas those of small isolated islands having originally the same elements as above become very substantial in the same course of time. The similarity of form between E. and W. exists mainly in lowland species, and in mountain species it is traceable in vicariating species, but it would lead us too far if we treated the high mountain fauna problem in this connection.

²⁾ To be excepted Cape York, for there an island bridge still enables recent invasions.

³⁾ KIRSCH, Lc., p. 126 (*D. decorata* HEW: Rubi, Inwiorage, S. and S. W. Coast of Geelvink Bay).

2. *Dicallaneura pulchra* GUÉR. 1830

Argynnis pulchra, GUÉRIN MÉNEVILLE, Voy. Coqu., Ins., 1830, t. 16 (Waigeo); *Emesis leosida*, BOISDUVAL, Voy. Antr., Ent. I, 1832, p. 65 (New Guinea); *Taxila pulchra* HEWITSON, Ex. Butt. IV, 1861; *Dicallaneura pulchra*, BUTLER, P.Z.S. 1867, p. 38; id., KIRBY, Cat. Di. Lep., 1871, p. 286; id., SCUDDER, Proc. Boston X, 1875, p. 156 (*pulchra* fixed as generic type); id. auct. sequ.

Stichel includes *princessa* GR. SM. from Schouten Is., but though it may really represent *pulchra* there, the differences are so substantial that I prefer to keep it separate till further data have been required.

We have to record the following *pulchra* subspecies:

a. *D. pulchra pulchra* GUER. 1830

Argynnis pulchra, GUÉRIN MÉNEVILLE, l. c. (Waigeo); *Emesis leosida*, id. (nec BOISDUVAL), l. c. II, 1832—35, text, p. 275 (id.); *Dicallaneura pulchra* GUER., BUTLER, l. c.; id., KIRBY, l. c.; id. STAUDINGER, Ex. Schmett. I, 1887, t. 87 ♂; id., text, 1888, p. 239, descr. ♀ (Waigeo); id., FRUHSTORFER, Berl. Ent. Z. 1898, p. 196; *D. pulchra pulchra* GUER., FRUHSTORFER Iris 1904, p. 147; id. in SEITZ IX, 1914, p. 787, t. 139 b (♀); id., STICHEL, l. c. 1928, p. 107; id., Lep. Cat XXXVIII, 1930, p. 112 and XL, 1930, p. 113 (Waigeo, non Dorey!).

STAUDINGER, who had received topotypical material from PLATEN, depicted a ♂ with a bluish-white broad uninterrupted upperside band and a very dark underside. FRUHSTORFER gave us in „Seitz” the corresponding ♀, but unfortunately its underside only. He nowhere published any detail about it except in a stray line between the scarce notes on other subspecies.

If we take STAUDINGER's short description as a base (”♀ with yellowish-brown basal half of forewing, darker brownish hindwings”), we can approximately figure the ♀ of the following subspecies, so far as these were known to FRUHSTORFER a.o.

The name *leosida* BOISD. was based on a ♀ specimen from New Guinea, as I can confirm after having carefully compared the details of Boisduval's description with a Manokwari specimen in my collection. It is therefore not an absolute synonym of *pulchra*, as STICHEL maintained, but a separate subspecies. STICHEL's habitat „Dorey” for *D. pulchra pulchra* must be cancelled.

b. *D. pulchra sigrya* FRUHST. 1914

D. pulchra sigrya, FRUHSTORFER l. c., p. 787 (Misool); *D. pulchra sigrya* (!), STICHEL, ls. cs.

Misool I.

♂ with a narrow white (?) band, which considerably narrows distally.

♀ much darker than *pulchra* ♀ but without the smoky-brown suffusion of the Humboldt Bay ♀ (FRUHSTORFER l.c.).

c. *D. pulchra vasatha* FRUHST. 1914.

Kapaur (Onin Peninsula, Neth. S. W. New Guinea).

d. *D. pulchra leosida* BOISD. 1832

Emesis Leosida, BOISDUVAL, l.c. (New Guinea; *Dicallaneura pulchra* GUER., OBERTHÜR, Ann. Mus. Civ. Gen. XV, 1880, p. 527; *D. pulchra pulchra* GUER., STICHEL, l.c., 1930, p. 112 (partim: Dorey).

3 ♂♂ 1 ♀, Manokwari District, acq. VAN DEN BERGH 1929, in coll. TOXOPEUS.

♂. *Upperside*: black with a deep ultramarine gloss. Forewing with a light blue band across the wing from vein 6 to vein 2, where it nearly reaches termen, this band is 34 mm broad and is composed of four spots, more or less separated by the veins. The most proximal spot, that between vein 6 and 5, is smaller than the next, which distally protrudes but proximally lies in a line with the former; the third spot lies more obliquely and is considerably shifted out, the last spot is as large as the third and still more shifted out, its inner edge originates at the mid-underside of the third spot. Below vein 2 there are a few scattered blue scales. — *Hindwing* with a beautiful purple gloss in some lights, costal area sordid yellowish light grey.

Underside: Ground-colour light brownish-orange. Forewing with a yellowish streak along costa from base to end of cell, a bluish-white streak in proximal part and a bluish-white triangular spot in distal part of cell near base, a light yellow streak below it; a very small yellowish bordering line at cell-end and a larger one outside it near costa coalescing with white cell streak; a white half-moon between vein 4 and vein 6; a rusty-brown field beyond, showing a faint purple gloss in some lights and bearing four small silvery-white spots arranged in pairs; a big oval creamy spot just outside this area between veins 2 and 3; a broken submarginal narrow fascia from costa to vein 1, its upper half consisting of little white dots, the lower half of more continuous light yellow streaks; marginal area brownish-orange with three apical silvery spots, the middle one largest, the upper spot ocellar with a black ringlet and silvery centre. Dorsal area light buff, turning gradually into orange towards vein 2. Fringe dark brown.

Hindwing orange-brown with light brown streaks and lines: discocellulars and median vein together with veins 1 to 4 to half their length broadly, and widening outwardly, lined with brownish-yellow-white, the innermost of them joined to anal area by a horizontal line of the same colour; three thick creamy curved lines from costa downward: the first near base, the second through middle of cell, the third beyond cell starting at mid-costa with a square spot and ending at vein 4. Two silvery-white spots in interspaces 4 and 5, the former arrowhead-shaped, the second club-shaped. Two curved fasciae from vein 4 to dorsal pale grey area, slightly wavy, the innermost broad, light and sharply defined by a light brown line, the latter thin and diffuse outwardly. Two black submarginal spots, one situated near the apex small and with a very small silver spot excentrically, the other one in the middle of the lobe, large oval, ringed with silver, further two submarginal silver streaks, about 1 mm broad, between these two black spots, and two similar silver streaks between lobe and anal angle.

♀. *Upperside*: forewing proximal half, from 2/5 of costa to tornus, yellowish-orange, distal half dark brown; edge of orange area runs irregularly. Two small brownish-orange apical spots at the dark brown margin. — Hindwing from costa to vein 5 like forewing, darker below this vein and gradually changing from light brown to buffish-brown in the anal area. A series of faint internerval dark submarginal marks between apex and lobe, the apical one best visible, being a small dark brown dot. Fringe alternately yellowish and brown, at lobe broadly brown.

Underside with the same pattern as in the ♂, but ground-colour and dark markings considerably lighter, the former yellowish-orange, the latter orange brown. Submarginal spots and streaks of hindwing smaller, but a trace of a third silvery spot above the club-shaped one.

Plesiotype ♀, neallotype and 2 ♂ paratypes in coll. TOXOPEUS.

Differs from typical *pulchra*-♀ (SEITZ t. 139 b) in the very light and yellowish underside (even the apex is broadly orange), and the much broader creamy curved bands of the hindwing. FRUHSTORFER's picture shows a well-developed third silvery spot near the apex of that wing, but it lacks the creamy basal triangular dot of the forewing underside. Probably this was rubbed in the specimen depicted.

I will repeat BOISDUVAL's original description here to show its identity with mine based on the ♀ plesiotype:

"*Alis anticis pallide fulvis extimo late nigro maculis duabus fulvis; posticis vix subcaudatis fulvo-ferrugineis, lunulis tribus caudaque nigris; anticis subtus basi fulva maculis tribus lineaque albis, extimo late nigris (apice excepto) maculis sex chalybeo-argenteis; posticis subtus rufo-ferrugineis nervis fascisque albis, insuper maculis duabus externis lineaque marginali chalybeo-argenteis*" (l. c. p. 65).

The characteristics printed in italics hereabove are those which especially fit to the Manokwari insect. Even the two small brownish-orange apical spots were mentioned by BOISDUVAL and these seem to be nearly or completely absent in the other subspecies, as no author has even observed them.

The ♂ is peculiar by the dislocation of its light blue band at two nerve crossings. In FRUHSTORFER's picture of „*ausuna*” - ♂ (SEITZ t. 140 c) this band is continuous, nowhere dislocated and of even breadth, and the same is to be seen in STAUDINGER's picture of onymotypical *pulchra*; with this the band penetrates the interspace below vein 3 to one-third.

This subspecies *leosida* must be very nearly related to *vasatha* FRUHSTORFER from Kapaur, but the information that author gives us is too scanty to draw a conclusion with some certainty. As long as there is no material available for a comparison it will be impossible to synonymize them.

e. *D. pulchra ansa* nomen nov.

D. pulchra GUER., KIRSCH, l. c., 1877, p. 126 (Ansus, Jobi Isl.); *D. pulchra ansuna*, FRUHSTORFER, l. c., p. 788, t. 140 c, ♂ (nec *ansuna*-♀); *D. pulchra princessa*, STICHEL, Iris 1926, p. 387 (1927), non *princessa* GR. SM.; id., in Tierreich 1928, p. 107; id., in Lep. Cat. 1930, p. 113.

Although the island Jappen, or as it was formerly called, Jobi, is situated in Geelvink Bay due S. of Schouten Is. (Biak), it is separated from it by a very deep strait of nearly thirty miles of width. The fauna is not the same nor even nearly related, such as one would expect: that of Biak possesses endemic species and much-deviating subspecies to an amazing percentage of its total whereas Jappen is nearly devoid of any particular form if compared with adjoining parts of New Guinea.

F. PRATT wrote about the differences of Biak and Jappen to JOICEY, and the latter published this letter in Trans. Ent. Soc. London 1916, p. 65; it contains the following note:

„The difference between the forms on Biak and their allies in New Guinea and Jobi (Jappen), as far as is known with regard to the latter island, is remarkable.”

JOICEY and TALBOT, in their enumeration of Biak butterflies, Bull. Hill Mus. IV, 1930, neglected Jobi or mentioned it in one line together with New Guinea.

ROTHSCHILD, STRESEMANN and KNUD PALUDAN, however, in describing the birds of the STEIN collection (Nov. Zool. XXXVIII, 1932, p. 207), declared, that Jappen possesses an avifauna which is „im wesentlichen nicht anders als eine verarmte Waropenfauna.” (Waropen is the name of the opposite coast of New Guinea).

With regard to birds the JOBI character is quite the reverse of that of the northern Geelvink Bay islands, i.e. Noemfoor and Biak.

Therefore I think it highly improbable that FRUHSTORFER's so-called „*ansuna*” ♂ from Jappen should belong to the endemic *Dicallaneura princessa* from Biak, although this was the repeatedly expressed opinion of Dr. STICHEL.

Moreover, if we compare the figures of *D. princessa*—♂ (JOICEY and NOAKES, Trans. Ent. Soc. London 1915, t. XXVI) and SEITZ t. 140 c, we see a noteworthy difference between them: the „*ansuna*”—♂ has a straight broad light blue band, and *princessa*—♂ shows a darker blue band which is broken up like that of *leosida*, but with this difference that the third spot is the largest and the fourth spot is the smallest of all. ¹⁾

For these reasons, to wit: 1o. a zoogeographical inconsistency or at least a strong improbability, and 2o. a divergence of character, I have come to the conclusion that „*ansuna*” may be listed amongst the non-aberrant *pulchra* subspecies, and has provisionally to stand as the subspecies for Jappen, though I believe that it will afterwards be found at the opposite New Guinea coast and probably as far as Mamberamo R. Only its name has to be altered, as *ansuna* was already reserved for the *decorata* subspecies from Jappen. Therefore I name it *ansa* (also derived from Ansus, where it was discovered).

Holotype, ♂, original specimen of SEITZ' t. 140 c (now possibly in the British Museum).

f. *D. pulchra udiyana* FRUHST. 1914

Dicallaneura pulchra GUER., GROSE SMITH, Zool. Nov. I, 1894, p. 543 (Humboldt Bay, Neth. N. New Guinea); *D. pulchra udiyana*, FRUHSTORFER, l. c., p. 787 (♀ only descr.); id., STICHEL, ls. cs.

1 ♀, Hollandia, 25. VI. 1938.

♂. Undescribed. (DOHERTY caught 2 ♂♂ and 1 ♀ near Hollandia, but FRUHSTORFER published a one-line description (sic!) of the female only).

1) JOICEY and NOAKES remark that this band is a little shorter and wider than in *pulchra* GUER., but the latter cannot be right. Most probably they had no onymotypical *pulchra* to compare with, but the Vogelkop subspecies *leosida* BOISD. instead. The authors' remarks hold good indeed for the difference between *princessa* and *leosida*.

♀. *Upperside*: 'hindwing darker than in specimens from Waigeo, suffused with smoky-brown' (FRUHSTORFER, l.c.).

Forewing: edge of orange area runs more smoothly than with *leosida* and turns inward at tornus; no brownish-orange spots at apex.¹⁾ *Hindwing*: brownish-orange costal-apical area reaches vein 5, thence rusty-brown gradually changing into smoky-brown. Submarginal black markings rather obsolete, but outer edge of upper three designated by a narrow orange streak.

Underside: forewing basal parts orange-brown with a similar pattern as *leosida*, but the brown disc extends further proximally, filling up all the space to the margin except a small field round the apical spots, which remains orange-brown. Base of cell darker, white cell-streak broader, basal white spot lengthened to a short line, cell-edge line crescent-shaped. Submarginal fascia rather degenerated. *Hindwing*: apical and submarginal areas, the latter up to lobe, remain brownish orange only, but the space between mid-costal fascia, the lower silvery spot, outer submarginal curved fascia and wing base completely saturated with rusty-brown. Veins very thinly (and to a shorter distance) lined white; all lines and fasciae cretaceous-white. Submarginal silvery-white markings reduced.

Abdomen above darker brown than with *leosida* ♀.

Plesiotype in Museum Buitenzorg.

Dicallaneura princessa GR. SM. 1894

Dicallaneura decorata, KIRSCH (nec HEW.), l.c., p. 126 (Korrido, Schouten Is. — sec. STICHEL, v. infra —); *D. princessa*, GROSE SMITH, l.c., p. 544 (♀: Biak); id., GROSE SMITH and KIRBY, l.c., II, 1897, *Dic. & Ab.*, t. I. f. 3, 4, p. 2; id., FRUHSTORFER, Berl. Ent. Z. XLIII, 1898, p. 196; id., Iris 1904, p. 147 (? = *pulchra princessa*); id., in Seitz IX, 1914, p. 788; id., JOICEY and NOAKES, Trans. Ent. Soc. London 1915, p. 196, t. 26, f. 6 (♂); *D. pulchra princessa* GR. SM., STICHEL, Iris 1926, p. 307 (partim: loc. non Jobi ins.); id., in Tierreich 1928, p. 107; id., in Lep. Cat. 1930, p. 113; *D. princessa* GR. SM., JOICEY and TALBOT, Bull. Hill Mus. 1930, p. 235.

3 ♀ ♀, Bosnik (Biak), 1929, acq. VAN DEN BERGH, in coll. TOXOPEUS.

Both ♂ and ♀ display a number of characteristics, which make the species stand alone in the genus *Dicallaneura*. The nearest relative is undoubtedly *pulchra* GUER., but the reasons for keeping the two species separate appear to be stronger for the moment than those to add it to *pulchra*.

Some points of difference are:

1o. ♂ forewing band stands more vertically and is consequently shorter, moreover it is rather darker blue;

2o. ♀ upperside colour is a rusty-brown all over, apical part of hindwing darker brown in stead of orange;

3o. ♀ forewing, edge of rusty and dark brown more vertical, dark wingborder terminates halfway below vein 2 but is still 5 mm broad there;

4o. ♀ forewing shows a patch of a rather strong blue gloss within the dark brown area;

5o. ♀ forewing lacks brown apical spots, but costa is faintly brown near apex;

1) Some orange scales can be found between the brown ones with a strong magnifying glass.

60. ♂ ♀ underside all fasciae of forewing broadened and shifted inward, therewith corresponding discal blue area restricted (shows a strong blue gloss), and silvery discal spots contracted resulting in these standing in a nearly straight line vertically to costa, the two large light discal spots (here being yellow) acquiring a similar position, whereas the three apical silvery spots, having got more room, were elongated to silver streaks;

70. ♂ ♀ underside hindwing innermost submarginal fascia shifted in at its upper part showing a stronger curvature (it is much thicker than in *pulchra*); all three silvery spots above it, having been shifted inward, naturally turned into short streaks.

These differences can be summarized in: a general tendency towards darkening the upperside colours and strengthening the underside markings, further in a centripetal movement of all the exterior parts of the pattern.

In no *pulchra* subspecies such a movement is even initiated, therefore I think this *princessa* may for the moment fully rank as a species.

I anticipate the discovery of a *princessa* subspecies on the island of Noemfoor W. of Biak, if there exists any of the kind.

3. *Dicallaneura ribbei* RÖBER 1886

Dicallaneura ribbei, RÖBER, Iris 1886, p. 49 (Aroe Is.); id., FRUHSTORFER, ls. cs.; id., STICHEL, ls. cs.

a. *D. ribbei arfakensis* FRUHST. 1898

Dicallaneura arfakensis, FRUHSTORFER, Berl. Ent. Z. 1898, p. 195 (♂: Arfak Mts., Vogelkop Peninsula, Neth. W. New Guinea); id., Iris 1904, p. 147 (partim: non Nova Guinea Germ.!).
D. ribbei arfakensis, FRUHSTORFER in SEITZ IX, 1914, p. 786 (♂ ex Montes Arfak, nec ♂ ♀ in tab. 139 b, nec in Aestuar. astrolabiense ut in texto); id., STICHEL, ls. cs.

Arfak Mts. (certainly not at high altitudes, most probably behind Manokwari on the outspurs of the hills). One ♂ hitherto known.

b. *D. ribbei birana* FRUHST. 1914

Dicallaneura ribbei birana, FRUHSTORFER, l.c. ♀: Etna Bay, S.W. Neth. New Guinea); id., STICHEL ls. cs.

2 ♀ ♀, Boeroc R., 25 miles S.E. of Etna Bay, 21. VII. 1942; 10 ♂♂, 2 ♀♀ Oemar R., 30 miles E. of Boeroc R., Neth. S.W. New Guinea (LUNDQUIST), in Museum Buitenzorg.

♂. *Upperside*: dark ultramarine-blue with a silky gloss, costa and apex of forewing and termen of hindwing brownish-black with a purple gloss in some lights, costal and dorsal area of hindwing drab, edged with dark brown inwardly.

Underside: common *ribbei* pattern, with the following particulars: forewing dark chestnut to dark brown, blue-iridescent discal area consisting of four streaks that project from the four bluish-silvery discal spots and are running between the chestnut-edged veins, apical silvery spots broadly edged by brown-orange, which extends to the middle of interspace 5, the marginal area therebelow deep tobacco-brown; submarginal fascia interrupted between veins 3 and 4, its subapical French lily emblem-shaped portion nearly stalkless; all spots and bands straw-yellow more or less orange-bordered, with the exception of the normally silvery ones and a subcostal cream-coloured cell-streak; origins of veins 2, 3 and 4 narrowly bordered with orange; discal spot in 2 roundish, about 3 mm in diameter, its orange ringlet connected with a narrow orange streak directed towards the wing-base; dorsal area light grey up to this streak; — hindwing groundcolour light chestnut, all discal and submarginal light spots and bands strawyellow, spots large and bands broad; discocellulars and veins 2 and 3 narrowly but clearly lined with light ochre-yellow; a small dark chestnut tooth at mid-costa; the same colour fills up the about 1 mm broad space between the wavy inner and outer submarginal fasciae.

♀. *Upperside*: brown apical part with a faint purple gloss, the browncolour of forewing protrudes into the yellow veins 3 and 4 and (with a sharp tooth) in the interspace below vein 2. Hindwing: tornal parts with a soft light grey suffusion.

Underside: forewing pattern much like that of the ♂, discal bluish area somewhat extended, dorsal area straw-yellow, well connected with the large spot in interspace 2, orange apical area extends to vein 5; hindwing a shade lighter but otherwise the same as that of the other sex.

♀ Plesiotype (Boeroe R.) and neallotype (Oemar R.) together with the other above-mentioned specimens in Museum Buitenzorg.

The original description of this subspecies was based upon one specimen from Etna Bay in the Tring Museum. Its author diagnosed it in two lines and compared it with an onymotypical ♀ from Aroe Is. It differed from that by its 'intensified black discal area of the forewing and narrower yellow bands of the hindwing underside'. (FRUHSTORFER l.c.).

As I have no Aroe material of this species I can not test FRUHSTORFER's words, but my *birana* specimens showing all spots and bands enlarged compared to the figures of other subspecies in SEITZ or SMITH and KIRBY's, the Aroe form should have the broadest bands of all subspecies.

My ♀ specimens from the two localities where the series was caught do not show the least difference, so I have not hesitated to include all specimens into one subspecies.

c. *D. ribbei ribbei* RÖB. 1886
Aroe Is.

d. *D. ribbei ovada* FRUHST. 1914
Eilanden R. (S. Neth. New Guinea).

One ♂ known, described as being large and dark and having small spots beneath.

e. *D. ribbei cyanandra* n. subsp.

5 ♀♀, Bernhard Camp, Idenburg., 50 m, 28. VIII, 19 and 26. IX. 1938, 12 and 13. IV. 1939.

♂ *Upperside*: differs from *birana* in the forewing having no long protruding tooth below vein 2 near tornus, there being visible a blunt projection only into the yellow part.

Underside: forewing very dark, the blue iridescence even entering the lower discal part of the cell, veins within this blue disc dark brown, except extreme lower cell-edge and veins origins thereabout, which are thinly lined with chestnut colour; marginal area dark brown, apical spots surrounded by chestnut but this colour much restricted, not reaching lower than vein 6; dorsal area and its connection with spot in 2 like in *birana*. Hindwing ground-colour as with that species, and pattern remarkable for the nearly complete reduction of the lining of the median veins; mid-costal spot large and brown, rather dark, emitting two dark brown spurs, one edging a series of three subbasal yellow spots exteriorly and proceeding as far as the lower cell border, the other one edging the mid-costal yellow bar interiorly as far as vein 5; a short brown band halfway dorsum separates a yellow dorsal square spot from the innermost submarginal brown band; light yellow spots and bands equal to *birana* FRUHST.

Holotype and three paratypes in Museum Buitenzorg, one paratype in the National Museum, New York.

Two specimens of these caught in August and September, are old and worn, all the others freshly hatched.

This subspecies is noticeable for its dark mid-costal marking in the shape of the Greek character π and the plain disc of the hindwing underside. The yellow bands are conspicuous because of their dark edges; this

is even more so with this than in the Astrolabe Bay subspecies (*arfakensis* FRUHST. in tab.), which seems to possess narrower and therefore less conspicuous bands.

To our regrets no male specimens of this beautiful new subspecies can be recorded: at the moment it flew less rarely than usual we left our camp: the last specimens being caught on our last collecting day there.

f. *D. ribbei hageni* nom. nov.

Dicallaneura pulchra, HAGEN (nec GUER.), Jahrb. Nassau. Ver. Naturk., L. 1897, p. 96 (Stephansort, Astrolabe Bay, 'German' New Guinea); *D. arfakensis*, FRUHSTORFER, Iris 1940, p. 147 (partim); id., in SEITZ, p. 787, t. 139 b (descr. fem. ac fig. maris feminaeque); id., STICHEL, ls. cs. (partim).

♂. *Upperside*: most probable that figured in Seitz t. 139 b.

♀. *Underside*: id., preceding figure, differs from *arfakensis* FRUHST. in the hindwing showing a similar mid-costal spot as *cyanandra* (the former has a mid-costal tooth only). Differs from the Idenburg subspecies by the narrow yellow bands and the smaller spots, the oval spot in 2 of the forewing not being conjoined to the yellow dorsal area; the innermost submarginal fascia of the hindwing being narrower than the brown fascia beyond it; but the French lily of the forewing has a long stalk.

Types in coll. FRUHSTORFER (now in the British Museum).

The difficulty to treat this form has not been the almost ever returning inconvenience to work with FRUHSTORFER's so-called descriptions, for FRUHSTORFER this time described *arfakensis* remarkably well (1898). He had, however, at the moment one ♂ only, from Arfak Mts. or thereabout. Later on, about 1904, he got Astrolabe Bay specimens of both sexes and included these in his *arfakensis*. When revising the genus in „SEITZ” he failed to separate the two subspecies, because they were in his own words „ziemlich übereinstimmend”. He forgot meanwhile that the roomly distance between Arfak Mts. and Astrolabe Bay measures more than 800 miles, whereas the Etna Bay subspecies, at less than 200 miles from Manokwari, he named with a new subspecific name. It is my opinion that FRUHSTORFER compared his Arfak and Astrolabe ♂♂ very superficially and not having an Arfak ♀ at hand, coupled the Astrolabe ♀ to his far-western ♂. The pictures in „SEITZ” subsequently were drawn after this Astrolabe material, at least that of the ♀.

The drawings of *Riodinidae* in SEITZ work seem to be well reliable upon, so I have not hesitated to base my description of the differential characters between the Idenburg and Astrolabe ♀ on a comparative study between that picture and my material. The trouble to separate the Arfak from the Idenburg and Astrolabe subspecies, was that I had not a single ♂ specimen of any of them, nor the Arfak ♀¹⁾.

For the time being the description of all North New Guinea subspecies of *ribbei* will have to remain defective.

C. *Species with the innermost submarginal light band of hindwing zigzagged, or when not being lighter than ground-colour its space inwardly edged by a dark zigzag line.* 2)

Dicallaneura kirschi RÖB. 1886

Dicallaneura kirschi, RÖBER, [Iris] 1886, p. 50, t. 5, f. 14 (♀: Aroe Is.); id., FRUHSTORFER, STICHEL ls. cs.

1) The Hill Museum will have received Arfak specimens from Messrs. PRATT and probably a ♀ amongst them that is now in the B.M., and the majority of VAN DEN BERGH's *Riodinidae* are stored in the Amsterdam Museum, amongst these a lot of specimens from Manokwari District, maybe these contain *arfakensis* ♂ and ♀.

2) I had no specimens nor literature of *D. albosignata* and *virgo* JOIC. and TALB. at my disposal. Both were treated as *spec. dub.* by Dr. STICHEL (l.c. 1928).

This is a very rare species, which is known from Aroe Is., Middle North, Far East and Middle South New Guinea (low altitudes), but not yet from Vogelkop Peninsula.

JORDAN (Nov. Zool. XL, 1937, p. 324) described as a subspecies *D. kirschi pelidna* from Momi, S. of Manikwari. The only specimen available, a ♂, had a blue upperside colour, whereas all the hitherto known subspecies of *kirschi* possess a red-brown ♂. In view of the fact that we discovered two new species nearly related to *kirschi* both with a blue ♂ makes it rather doubtful that *pelidna* belongs to *kirschi* s. str. Therefore I should prefer to keep JORDAN's insect separate as a species till further data arrive. It should be called *D. pelidna* JORD.

We failed to capture specimens of *kirschi* but I found a ♀ of *D. kirchi semirufa* GR. SM. in the Buitenzorg Museum. As this sex has not yet been described I will append its description here.

D. kirschi semirufa GR. SM. 1894

D. semirufa, GROSE SMITH, Nov. Zool. I, 1894, p. 544 (Humboldt Bay); id., GROSE SMITH and KIRBY, Rhop. Ex. II, Dic. & Ab. I, 1897, f. 5,6, p. 1 (♂); id., FRUHSTORFER, Berl.Ent. Z. 1898, p. 196; id., Iris 1904, p. 147; *D. kirschi semirufa* FRUHSTORFER in Seitz, p. 787, id., STICHEL, ls. cs.

1 ♀ Hollandia, VI. 1932, acq. Mrs. M. E. WALSH, in Museum Buitenzorg.

♀. *Upperside*: shows much resemblance to *D. kirschi udiyana* FRUHST. from the same collecting-place but forewing yellow area reaches far beyond outer cell-edge and black border above tornus still 3 mm broad; hindwing grey-brown darkest at tornus light yellowish-grey at costa but no broad yellow apical-costal part as in *udiyana*.

Underside: central part of forewing light ochre-yellow, narrow at subcosta beyond cell-end, rapidly broadening to dorsum and marginal fascia below vein 3; basal part and cell greyish, with a bluish-grey streak and crescent, next to that a cell-closing orange crescent with a thin brown dividing line running through the middle; two discal spots large, milk-white; further a triangular spot at costa near upper point of postcellular discal spot, two white dots above each other at 3/5 of costa, a series of three bluish-silvery spots each with a blackish streak iridescent blue directed towards wing-base and a cluster of small white spots at upper end of submarginal fascia; below these the fascia consists of two short streaks below each other, both ill-defined, therebelow it is interrupted and then follow two creamy streaks (about 1 mm broad) and a white dot at tornus; in the marginal zone two subapical white spots, the upper one smaller with a black border, both outwardly lined with some dark brownish-orange, marginal area as well as veins running between the narrow black streaks chocolate-brown; dorsum light grey. — Hindwing ground-colour deer brown pattern nearly identical to ♂ with the following noticeable details: innermost apical spot very large and pure white, it reaches veins 5 and 6; a bluish-white unsharply defined spot below it; apical submarginal spot large and oval, black with an eccentric silvery dot; black caudal spot large, ointment-pot shaped with a straight, broad, whitish-silvery basal line.

Neallotype, unique, in Museum Buitenzorg.

4. *Dicallaneura hyacinthus* n.sp.

2 ♂♂, 1 ♀, Araucaria Camp, 800 m. II. III, 1. IV and 3. III. 1939.

♂ *Upperside*: dark indigo-blue with a soft silky gloss; costa of forewing brown; hindwing costal border brownish-purple ranging as far as apex, wing-base and dorsum brown. *Underside*: ground-colour brown in various shades. Forewing base deep brown, disc with a dark bluish-purple gloss, marginal area dark chestnut, getting lighter along the extreme border; dorsal area light grey turning to brownish-orange between veins 1 and 2, the orange colour gradually darkening and changing into chestnut between 2 and 3 and in the corner above origin of vein 3. The following streaks and spots are strewn over the wing surface: a light grey basal streak and the usual crescent in the cell, a thin black outer cell-edge mark;

beyond this a pear-shaped white discal spot and a small pointed arrow-head-shaped costal spot above it; a diffuse white oval discal spot measuring about 2 mm in diameter above vein 2 and a white dot above this in interspace 3, both inwardly with a dark chestnut cap; two white dots, one superimposed on the other, at $3/5$ of costa, bluish-white; three light blue dots in a slight curve in interspaces 3 to 5, a rather large bluish-white spot in 6 above the latter and a smaller one above it again near costa at beginning of submarginal fasciä; this consists of a series of small white double dots astride of veins 7 to 5 and a continuous white streak from halfway vein 4 down to 2; apical spots three, light blue, middle one much larger than the others. Fringe dark brown. Hindwing purplish-brown, discal part with a faint purplish gloss, discocellulars and radiating veins lined with buffish-white, a conspicuous white crescent within cell and four white basal spots and streaks below it; a square white mid-costal spot and ejected from it an oblique white line getting thinner, to vein 4; two conspicuous bluish-white subapical spots in interspaces 4 and 5, and a sharply zigzagged greyish-white fascia from vein 4 to dorsum; apical spot round, black, with an eccentric silvery-white dot, lobal spot large, roundish, black, adorned with a silvery basal bar; the usual four submarginal internerval silvery streaks each on a black ground; bars and spots from vein 4 down to dorsum surrounded by ochre-yellow and inwardly capped with light grey lines, that of lobal spot being broadest measuring about 1 mm; apex (from mid-costa) and submarginal area to lobal spot brownish-orange.

♀ (too old and worn to allow a full description). *Upperside*: forewing buffish-yellow with a brown costa, a broad black apical area with some purplish gloss, the black protruding above vein 4 and quickly receding below it running to halfway vein 2 where it meets the marginal border; the latter is 2 mm broad down to tornus; basal part with some greyish suffusion. Hindwing brownish-buff with a light costal area (colour indefinable) and a series of diffuse black submarginal spots (the apical one most conspicuous of them).

Underside: forewing with apical area as above, a blackish cross-bar at outer cell-edge (colour and markings mostly rubbed out, but spots still faintly visible having the same position as with ♂). Hindwing too much worn to get a tolerable description from it. The mid-costal white spot and slightly curved white line seem to be broader than in the ♂: the white colour possibly even extends as far as apex.

Holotype: ♂ (specimen caught April 1st.), allotype and 1 ♂ paratype in Museum Buitenzorg.

5. *Dicallaneura cyanea* n. sp.

1 ♂, Rattan Camp, 1200 m, 20. II. 1939.

♂. *Upperside*: dark brownish-purple with some more gloss than the

former species. Forewing: costa brown; hindwing costal area purple-brownish to vein 6, dorsal area dead brown.

Underside: dark brown with nearly the same pattern as the former species, but differs in the following respects: dorsal area grey without a trace of orange, apical and submarginal parts deep brown, discal white spot behind cell crescent-shaped and white dot above it as costa in stead of a pointed spot; submarginal dots of upper half of fascia between veins 5 and 6 directed inward to constitute a diffuse flying bird looking mark; subapical spots two only, the upper one much larger than in *hyacinthus*. Hindwing with a smaller white crescent within the cell, likewise a smaller mid-costal spot; vein edgings clear grey; costal area only faintly tinged with orange but there are three in stead of two bluish-white subapical spots superimposing each other (the one in 6 missing in *hyacinthus*); greyish-white zigzag line more diffuse; submarginal silvery bars broader and a pale yellow bordering line runs along the outer margin. Palpi light grey in stead of the usual pure white.

Holotype, unique, in Museum Buitenzorg.

This species and the preceding one have to be counted among the most striking results of the expedition as no one could expect new *Dicallaneura* species to turn up from the rather thoroughly explored hill forests of New Guinea.

Doubtlessly we have here to do with very rare species, such as relatives of *kirschi* all are as a matter of fact. This group consists of small species (if in *Dicallaneura* where the differences in size are very immaterial and do not exceed the normal variability of one species it is allowed to speak of smaller and larger), which show a remarkable uniformity regarding wing form (short and rectangular) and underside pattern, besides three out of the four hitherto known species having a dark blue upperside (*pelidna* JORD., *hyacinthus* and *cyanea*), the only exception in this respect being *kirschi* with a brown male.

The rare occurrence of these species is to be elicited from the small numbers of specimens in collections, ours not excepted. A month of assiduous collecting brought forth one *cyanea*-♂, the following month in a good collecting place and with full assistance of eight trained collectors only three *hyacinthus*, one of this small set, moreover, worn to the last thread, and two months of successful butterfly hunting near Hollandia by the same boys were obviously not enough to delight us with a single specimen of *kirschi*. *D. pelidna* is known from its type specimen only, and so are the majority of the *kirschi* subspecies.

Therefore it seems evident that the discovery work in Riodinidae has not yet arrived at the bottom, even not in rather well-searched districts.

The next species are inhabitants of high mountain territories. The undersides of these show a less zigzagged submarginal fascia of the hind-

wing but its inner edge consists of dark spots with sharp points directed towards the wing-base. They constitute a natural group to such a degree that it is a difficult task to combine the sexes of one species if there is a chance of more than one species flying at the same spot, and there exists a still greater difficulty in identifying the subspecies belonging to one species.

Some species have their sexual dimorphism highly developed, others are more or less monomorphic. Two species which display great similarity in their ♂ pattern may differ in one having a white and the other one an orange ♀.

ROTHSCHILD, the first author to described this mountain species, started with a mesalliance of *amabilis* ♂ and *leucomelas* ♀, an error which, however, was quickly restored when the real ♂ of *leucomelas* got discovered.

JOICEY and NOAKES have with great skill unravelled three species occurring together in the high Arfak (Anggi Lakes), but were in doubt as to their correctly mating the ♀ of *D. fulvofasciata*.

We collected two high mountain species besides the easily identified *D. leucomelas*, which as a rule flies at a lower altitude.

Here follows a key of all mountain *Dicallaneura* species sofar known with the exception of *D. albosignata* JOIC. and TALB., which had to be omitted owing to want of information on that species.¹⁾

♂ sex.

1. Upp. forewing with a white discal patch *leucomelas*,
Upp. forewing with an orange band or basal area orange 2
2. Upp. forewing basal third dark brown sharply separated from orange fascia *amabilis*
Upp. forewing basal third ochre or brown with a diffuse outer edge 3
3. Und. hindwing postcellular brown fascia interrupted at veins and hence broken up into
separate spots; und. forewing submarginal fascia grey, welldefined *exigua*
Und. hindwing postcellular fascia straight, continuous; und. forewing submarginal
fascia brownish and very faintly visible 4.
4. Und. forewing with broad brown dividing line through fascia between veins 2 and 4;
silvery streak in interspace 5 sifted in *dilectissima*
Und. forewing with thin brown dividing line; silvery streak in interspace 5 in line
with the others *fulvofasciata*

♀ sex.

1. Upp. forewing ochre-yellow to orange *amabilis*
Upp. forewing white or creamy 2.
2. Upp. hindwing grey with only a narrow white costal area; und. hindwing two black sub-
marginal spots of equal size near apex. or at least the lower one much broader than the
next silver-adorned submarginal black streak *leucomelas*
Majority of hindwing upp. whitish or creamy 3.
3. Und. hindwing postcellular brown fascia divided by the veins, the thus separated spots en
échelon *exigua*
Und. hindwing postcellular brown fascia straight and continuous 4

1) This was caught in the Wandammen Mts. S. of Geelvink Bay; maybe it represents one of the following species as a subspecies there.

4. Upp. hindwing pale straw-yellow; und. forewing with brown dividing line (1 mm broad) running through fascia between veins 2 and 4; silvery streak in interspace 5 shifted in; und. hindwing without protruding white costal patch *di'ectissima*
 Upp. hindwing white; und. forewing no brown dividing line; silvery streak in 5 in line with the others; und. hindwing with large white costal patch protruding almost to vein 4 *fulvofasciata*

6. *Dicallaneura leucomelas* ROTHs. and JORD. 1905.

Dicallaneura amabilis, ROTHsCHILD, Nov. Zool. XI, 1904, p. 318 (partim), t. II, f. 22, ♀ (Owgarra, N. of the head of Aroa R., Brit. New Guinea); *D. leucomelas*, ROTHsCHILD and JORDAN, Nov. Zool. XII, 1905, p. 464 (♂ type and ♀: Angabunga R., 6000, Brit. New Guinea); id. FRUHSTORFER in SEITZ IX, 1914, p. 786, t. 140c, f. 4, ♀, 5, ♂ und. (non f. 3 = *D. amabilis*-♀ und.); STICHEL ls. cs.

a. *D. leucomelas leucomelas* ROTHs. and JORD. 1905.

South side of Owen Stanley Range, Brit. New Guinea.

b. *D. leucomelas discifera* n. subsp.

1 ♀, Rattan Camp, 1200 m, 16.II. 1939; (a ♂ specimen was observed near Sigi Camp at about 1400 m, but escaped).

♀ *Upperside*: differs from typical *leucomelas* in the rounded white discal patch of the forewing (not showing the deep rectangular incision above vein 4) and the very narrow white costal streak of the hindwing (not extending below vein 6), the submarginal spots being very faintly visible.

Underside: forewing deep chestnut-brown, not reddish-brown; white central patch somewhat reduced but still nearly touching a comma-shaped white mark at 2/3 of costa; silvery patches situated along inner side of continuous light grey submarginal fascia macular (not linear); hindwing marked like in typical *leucomelas* but for two silvery patches lying inwardly of the big black spots in interspaces 5 and 4 and two thin silvery lines correspondingly in 3 and 2; the black spots in 5 and 4 being surrounded by rusty-brown.

Basal parts of both pairs of wings woolly with short crisp white hairs.

Type, unique, in Museum Buitenzorg.

The specimen is old and rather damaged at the right hindwing, but the left pair of wings are entire except half of the lobe missing.

This seems to be the first record of this rare species so far west.

7. *Dicallaneura amabilis* ROTHs. 1904.

Dicallaneura amabilis, ROTHsCHILD, Nov. Zool. XI, 1904, p. 318, t. II, f. 21, ♂ (Owgarra, N. of headwaters of Aroa R., Brit. New Guinea; non ♀ = *leucomelas* - ♀); id., FRUHSTORFER, Iris 1904, p. 147; id., ROTHsCHILD and JORDAN, Nov. Zool. XII, 1905, p. 463 (♀: Angabunga R., above 6000'); *Practaxila amabilis*, FRUHSTORFER in SEITZ IX, 1914, p. 795, t. 140c, f. 3, ♀ und. (called *leucomelas* U'); *Dicallaneura amabilis*, STICHEL, ls. cs. (1927 etc.).

This *Dicallaneura* species may be identified by the sharply limited orange band of the forewing in the ♂ sex and the ochre-yellow ♀, and by the underside showing a strongly curved row of silvery discal streaks

in the forewing and the first submarginal silvery streak (i.e. that next to the subcostal ocellus) missing in the hindwing with both sexes.

Subspecies are now known from many mountain systems of New Guinea but not yet outside the main island. The most abnormal form is *angustifascia* from Arfak Mts., which was considered a separate species by STICHEL, though the authors, JOICEY and NOAKES (not JOICEY, NOAKES and TALBOT!) described it as a subspecies of *amabilis*. I have treated it as such, though I admit there are important reasons to separate it from the main stock (the most obvious points of difference being the colour of the hindwing above and beneath and the narrowness of the oblique fascia of the forewing underside). Considering the fact that most subspecies of the Vögelkop Peninsula mountains are very peculiar and that the more important features of *angustifascia* correspond to *amabilis*, it may be regarded as a representative of that species after all and be ranked as a subspecies. The subspecies of *D. amabilis* and their hitherto known areas are now:

a. *D. amabilis angustifascia* JOIC. and NOAKES 1915

Anggi Lakes, 6000' Arfak Mts. (Vogelkop Pen.).

b. *D. amabilis mimica* JOIC and TALB. 1916

Dicallaneura amabilis mimica, JOICEY and TALBOT, Ann. Mag. Nat. Hist. 1916, p. 78, t. 8, f. 4 (Wandammen Mts., S. of Geelvink Bay): id., STICHEL ls. es.

? 1 ♂, Dejedeta or Barara, near Wissel Lakes \pm 1750 m, Neth. S. W. New Guinea, 10-11. IX. 1939 (leg. BOSCHMA).

The identification of this specimen captured during the Le Roux Expedition to Wissel Lakes and the slopes of Nassau and Weyland Mts. is provisional. The difference between forms from Wandammen Mts. (whence *mimica* was described) and Weyland Mts. (the eastern slope of which was the habitat of my specimen) is the merest trifle in most cases, so that I refrained from creating a probably superfluous name.

Distinguishing characters by means of which anyone may afterwards separate it from *mimica* will follow herebelow under the next subspecies: if I use the name '*mimica*' there it denotes the Wissel Lakes specimen.

D. amabilis praedilecta n. subsp.

1 ♂, Mist Camp, 1800 m, 12.I.1939; 1 ♀, Top Camp, 2100 m, 25.I.1939.

♂ *Upperside*: forewing as *mimica* but the portion of the orange fascia above vein 4 is 3 mm broad in stead of 2.5 mm and the lower rounded part of that fascia protrudes farther into the submedian area. Hindwing as with *mimica*.

Underside: as *mimica* but the proximal part of the forewing fascia equally broader, especially at costa; correspondingly the wedge-shaped white line descending from $4/5$ of costa much broader than with *mimica*. Hindwing subapical spot larger and brown colouration more vivid chocolate-brown.

♀ *Upperside*: forewing very near to *casis* JORD. from Goliath (see below), but differs in having a brown dot at origin of vein 5 and the oblique fascia (which reaches dorsum) is pale orange in stead of pale

yellow. Hindwing brown lighter at base, gradually darkening towards anal lobe; light brown area extends to vein 5 but is suffused with brown in interspace 5; subapical spot roundish, all other submarginal spots only faintly visible; two narrow bright orange lines bordering the subapical spot and the one below it; extreme lobe with edge orange; the fringe light buffish-yellow at places corresponding with these orange admarginal lines.

Underside: similar to *amabilis*-♀ picture in SEITZ, t. 140e, f. 3 (*leucomelas* U erre!) but a curved light brown line runs through the light yellow band of the forewing parallel to the dark brown cell-closing crescent; it further displays the same brown submedian streaks as *casis* and its more than 1 mm broad dividing line between veins 2 and 4 besides the chestnut apical area fully reaching vein 2 at the basal side of the thin orange submarginal fascia. Hindwing with no trace of a silvery inner streak in interspace 3 and the outer streak being reduced to a few sparse silvery scales of the lower portion; the brown zigzag fascia is broader than with typical *amabilis*-♀ and light brown; apical area orange-brown, a thin brownish-orange line links this with the orange outer edge of the lobal spot.

Holotype (♂) and allotype in Museum Buitenzorg.

d. *D. amabilis casis* JORD. 1912.

Mt. Goliath (Snow Mountains at headwaters of Eilanden R.).

Only ♀♀ known.

e. *D. amabilis amabilis* ROTHs. 1904

Owgarra (type ♂), Angabunga R. (allotype) (Slopes of Mt. Albert Edward, Brit. New Guinea; Herzog Mts. (Huon Pen., 'German' New Guinea).

The latter locality is based on a ♂ specimen of the EICHHORN captures of 1928 (6100'), which were identified by dr. KARL JORDAN (Proc. Ent. Soc. London 1930, p. 60); this was the second ♀ specimen of the Tring Museum collection at that time. Herzog Mts. species as a whole seem to show little subspecific differences if compared to Owen Stanley Range representatives, which is specially evidenced by the immaterial changes the *Delias* fauna displays there.

8. *Dicallaneura dilectissima* n. sp.

1 ♂, 1 ♀, Moss Forest Camp at 2600 m. 29 and 24. X. 1958.

♂ *Upperside*: forewing base olive-brown including a dark brown patch at the obtuse angle of the cell-edge, thence a brown suffusion to incurvent black border above 2/3 of dorsum; oblique fascia consisting of four bands or thick lines alternately orange-ochre and light yellow, the ochre lines fusing into a triangular area of the same colour with its base on vein 2 and its top at 1 mm from dorsum; costa, apical half and outer border brown-black, this border about 4 mm broad at vein 2, thence incurving to 2/3 of dorsum. Hindwing olivebrown covered with many shining hairs; costal area brownish-grey; submarginal spots little darker than ground-colour, adjoining to constitute a meandering line; lobal spot adorned with an orange and yellow oval outer dot.

Underside: ground-colour maroon with a darker reddish-brown discal patch in the forewing. Forewing: two light bluish-grey crescent-shaped

thin lines within the cell, a dark chestnut-brown cell-closing bar, an orange-brown fascia next to it from upper edge cell to vein 2, a creamy band from costa to vein 2 fusing there with yellowish portion of dorsal area and cut in two by the light brown dividing line (this little more than 1 mm broad); a thin white line from costa at $3/5$ to vein 6, a broader one, wedge-shaped, at $4/5$; three thin whitish-silvery discal marks between veins 3-6: the lower two in the production of the white costal bar at $4/5$, the upper one shifted in half the distance between the middle one and the white costal mark at $3/5$, this upper silvery streak being hook-shaped; submarginal fascia buffish, rather well visible near tornus, widening but getting diffuse above vein 4 and ultimately lost in a greyish suffusion of the apical area; one very small whitish-silvery apical dot; dorsal area basally maroon-colour, this spreading along cell to the dividing line of the fascia, which it just touches, lower part buffish-creamy, light grey near tornus gradually changing into brown towards vein 2. Hindwing with two thin grey oblique cross-bars within the cell and a parallel one beyond, another straight but faint line from mid-costa to vein 4, a brown bar of equal width between the latter two; lower discocellulars and veins 2-4 light greyish edged; three short silvery-white streaks in interspaces 4-6; brown zigzag fascia distally farther from termen than with *fulvofasciata*; submarginal black spots and streaks much like in that species, but upper streak reduced and not adorned with silver, besides area and bordering line reddish-brown mixed with orange and lobe tipped with yellow.

♀ *Upperside*: pale straw-yellow like bleached oat-straw. Forewing with a 4-6 mm broad creamy-white fascia from costa to below vein 2, where it gradually merges into the straw-colour; the dividing line from below faintly indicated by light grey; outer edge of fascia yellowish, this widening near tornus; costa very thinly and apical third brown-black with a projecting tooth above vein 4, thence the black edge runs to tornus in a smooth curve. Hindwing paler at costa, darker and greyish at dorsum; near tornus a light purplish-grey, pale yellowish grey and brown are flowingly mixed like in some *Tenaris* species; four black submarginal spots, three of them surrounded by orange-yellow, the lobal one merging into the tornal brown; lobe broadly tipped with orange-yellow; fringe opposite to orange places light yellow.

Underside: forewing with the cell maroon colour extending to costa; a thin grey streak below median vein and two thin light grey basal longitudinal streaks on either side of the subcosta; two light grey crescent-shaped transversal marks within the cell, the outer one of which being small does not reach the cell-edges; cell-closing bar chocolate-brown; a broad white fascia corresponding to that above, divided by a thin light brown line running from 4-2; apical third chocolate-brown, costal cross-bars broader than in ♂, apical dot smaller barely visible; three silvery

streaklets situated like in ♂ but upper two being crooked; submarginal fascia yellowish, vanishing above median fold of interspace 3; dorsal area creamy-white becoming sordid yellowish-creamy near base and tornus. Hindwing: ground-colour greyish-maroon with grey lines and vein-edgings, and with maroon-brown fasciae as with the ♂; further there is a small white square spot at mid-costa and a longitudinal white spot below it shifted out, conjoined above to the upper white submarginal streak by the whitish portion of vein 7; upper two submarginal streaks larger than with ♂, apical and admarginal orange areas more extended, bluish-silvery spots and streaks decidedly larger.

Both sexes of about same size as *D. fulvofasciata* JOIC. and NOAKES.

Holotype (♂) and allotype in Museum Buitenzorg.

This species is very near to *D. fulvofasciata* from the Arfak Mountains and I have long hesitated to separate them as species, the more so as with other butterflies the Arfak form mostly shows a kind of insular isolation effect to such an extent as to tempt a systematist to produce a specific separation based on technical grounds. It is the biological factors which in such case should give the decision and whereas these mostly remain hypothetical the splitting-up of species or the unification of subspecies depends on the feeling of the author.

In this special case, however, we are able to combine a technical distinctness (which I will discuss herebelow) with the biological separating factor of the unequal "habitats" ¹⁾, *D. fulvofasciata* being found at 6000' and *dilectissima* at nearly 9000'. As we observed great and fundamental changes in the fauna and flora of the mountain districts at altitude intervals of even less than 2000', a difference of nearly 3000' of altitude is as a rule too much to overlap (compare with *Delias* e.g.).

D. amabilis praedilecta is another form very near to *dilectissima*, and had I not had the good fortune to capture both sexes of them, it would have been a tough job to separate them satisfactorily.

The distinguishing characters are as given in the schedula, and I think the following points with regard to *fulvofasciata* the most valuable: the dislocation of the silvery streak in interspace 5 of the underside of the forewing and that of the zigzag fascia of the hindwing. The other characteristics: more yellow colour of *dilectissima*-♀, other curve of outer edge of forewing fascia, yellow in stead of white lobal tip seem to be of less importance.

My descriptions were made after a perfectly fresh ♀ specimen, the ♂ is older and a little damaged but still in good condition; my pair of *praedilecta* were quite fresh, and the ♂ is lacking the apical part of the right hindwing.

1) This once more emphasizes the necessity of an absolutely reliable labelling: data as „Mt Carstensz, 5000—10000 feet" prove to be quite insufficient.

The ♀ of *dilectissima* is one of the most magnificent *Dicallaneura*'s, it equals at least the *fulvofasciata*-♀.

II. *Sospita*

Sospita, HEWITSON, Ex. Butt. IV (2), 1860, text of t. *Sospita* (type: *segecia* according to STICHEL); id., SCUDDER, Proc. Am. Ac. Arts and Sc., Boston, X, 1875, p. 269 (designates *fylla* HEW. as type, rejected by STICHEL); id., OBERTHÜR, l. c. 1880; id., STICHEL, Iris 1926, p. 387 (1927); id. id. 1928, 1930 ls. cs.; *Praetaxila*, FRUHSTORFER, in SEITZ IX, 1914; *Holodesmus*, WATERHOUSE and LYELL, Butt. Austr., 1914, p. 67.

The name *Holodesmus* WAT. and LY. was preoccupied by *Praetaxila* FRUHST. (by three months), but HEWITSON's name being applicable to *segecia* HEW. (on STICHEL's authority) both names fall before *Sospita*.

I will have to deal with six species in the following pages, though there were only four represented in our captures.

Sospita segecia HEW. 1860

„New Guinea" (HEWITSON).

KIRBY's Catalogue mentions Mysol and Aroe Is. only (Cat., 1871, p. 285); STAUDINGER repeats this (Ex. Schmett. 1888); so does ROTHSCCHILD (Rep. Woll. Exp. 1916); but WATERHOUSE and LYELL give New Guinea as HEWITSON's „habitat"; FRUHSTORFER mentions New Guinea, but adds the supposition that WALLACE (the discoverer) might have caught it at Dorey or on the Aroe Is., whereupon the same author gives a diagnose of the Aroe insect as being typical. WALLACE's localities are well trustworthy and his specimen may therefore have been collected at any locality whence WALLACE sent home collections of butterflies from New Guinea, i. e. Dorey (= Manokwari), Amberbaken (= N. coast of Vogelkop Pen.) and Sorong (where his assistant ALLEN worked for him).

I have found no records of *segecia* being rediscovered at the northern side of the peninsula, though two ♂♂ in Museum Leiden mentioned by VAN EECKE (Nova Guinea XIII, 1915, p. 55) were from between Mc. Cluer Gulf and Argoeni Bay, an adjacent country.

Afterwards a *segecia* subspecies has repeatedly been found in Aroe and I have 1 ♂ and 1 ♀ from Dobo (Aroe Is.) before me now. These correspond to STAUDINGER's pictures, (made after Aroe specimens) and FRUHSTORFER's description (idem), but I had no opportunity to compare them with HEWITSON'S types and figures or to the specimens of VAN EECKE's. I entertain little doubt that the local forms from Vogelkop Pen. and Aroe Is. are not identical and that therefore the latter deserves a special name.

The following subspecies are to be recorded up to now:

a. *S. segecia segecia* HEW. 1860
Vogelkop Pen.; (?) Onin-Pen. (VAN EECKE).

b. *S. segecia* subsp.

Aroe Is.

c. *S. segecia cariya* FRUHST. 1914

Praetaxila segecia cariya, FRUHSTORFER in SEITZ IX, 1914, p. 794 (Setekwa R., Eilanden R., Neth. S. W. and S. New Guinea); *Abisara segetia* (sic!) HEW., ROEBER, Nova Guinea XIII, 1915, Zool., p. 49; *Praetaxila segecia* HEW., VAN EECKE, l. c., p. 74 (Lorentz R.); id., ROTHSCCHILD, Rep. B. O. U. and Woll. Exp. II, 1916, Lep., p. 26 (Utakwa R.); *Sospita segecia cariya* FRUHST., STICHEL ls. cs.

3 ♂♂, 4 ♀♀, Boeroe R. (25 miles S. E. of Etna Bay), 21. VII. 1941; 2 ♀♀, Aindoea R. (30 miles E. of Boeroe R.), 4. VII. 1941; 1 ♀, Siera R. (W. of Oeta R.), 17. VI. 1941, Neth. S. W. New Guinea; 1 ♀, Upper Digoel R., II. 1932, Neth. S. New Guinea (acq. Mrs. M. E. WALSH).

Differs from Aroe specimens in the ♂ sex in having a rectangular triangleshaped white spot with an incision above behind the forewing cell in stead of an irregular oval spot, and at the underside in

having the two subapical white dots of the forewing reduced to nearly nothing, the bar in the cell, the discal fascia and the submarginal spots are whiter, the latter not more or less orange below vein 3; the hindwing ground-colour is of a clearer grey and the discal spots between 2 and 4 are much darker brown and not mixed with orange.

The ♀ shows a broader white fascia within the cell of the forewing above and below; the area between the central black cell spot and cell closing bar is whitish or light grey and generally connected to the fascia by a thin grey line below the cell closing black bar, whereas in the Aroe ♀ this area is as dark as the ground-colour; the white fascia is continued to far below vein 2; discal spots of hindwing a little darker rusty brown.

My Aroe ♂♂ have one tiny white apical dot above, one of the Boeroe R. ♂♂ is just like that, the two others show two well-developed white dots. Presence or absence of these dots is therefore no distinguishing character. The same obtains for the dimensions of the discal spots of the ♀ hindwing below: the specimen from Eilanden R. shows them very small and the others have them larger though with a great deal of variability.

There is one ♀ (Siera R.) that shows a darker colour above than all others, especially in the basal area of the forewing, which is devoid of the rustypbrown washing of other fresh specimens.

Old and worn samples display a lighter colour than fresh ones, the Digoel R. specimen, for instance, is quite faded.

d. *S. segecia yaniya* FRUHST. 1914

Yule Isl. (♂ type); Aroa R. (allotype); S. British New Guinea.

e. *S. segecia punctaria* FRUHST. 1904

Cape York; N. Queensland.

It is a remarkable fact with this species that it has not yet been recorded from the whole northern part of New Guinea, with the possible exception of the Vogelkop Pen.

Sospita statira HEW. 1861

We did not succeed in catching a single specimen of this species, though it is known to occur in the Mamberamo valley: one ♂ specimen being mentioned by VAN EECKE as *Praetaxila statira naram* FRUHST. (l. c. 1924, p. 40).

The name *naram*, however, denounces the subspecies from Kapaur, Onin Pen. (strictly speaking), and specimens from that locality and Mamberamo ones are, as a rule, widely different. The latter form is nearer to that from Astrolabe Bay; I think therefore that VAN EECKE's specimen is near to or identical to the still undescribed ♂ of FRUHSTORFER's *S. statira vedalla* from „German” New Guinea.

Praetaxila statira naram was recorded from an unknown locality, which on the strength of certain specimens of the same collection was elucidated by FRUHSTORFER to be situated near Etna Bay, but presumably this 'locality X' has been a place rather more westwardly, for near Etna Bay the full weight of the Southern plain is already discernable. The S. New Guinea subspecies of *S. statira* is *S. segecia dhyana* FRUHST., which we will pay some attention to herebelow.

S. statira dhyana FRUHST. 1914

Praetaxila statira dhyana, FRUHSTORFER in SEITZ IX, 1914, p. 795, t. 140f (Upper Setekwa R., 1000 m); id., ROTHCHILD, l. c. (Utakwa R.); *Sospita statira dhyana* FRUHST., STICHEL ls. cs.

1 ♀, S. W. New Guinea 1911 (leg. DUMAS); 1 ♀, Aindoea R., Neth. S. W. New Guinea, 4. VII. 1941, leg. LUNDQUIST, in Mus. Buitenzorg.

There is a rather great amount of variation in the underside pattern of this subspecies. The second specimen is similar to the *dhyana* picture in SEITZ in this respect, the difference consisting mainly in the brown diffuse caps of the hindwing submarginal series not being confluent towards the costa. The first specimen is smaller, and it lacks furthermore the dark brown intervenal stripes below the cell in the hindwing beneath, this giving a quite other appearance.

9. *Sospita tyrannus* GR. SM. and KIRBY 1897.

Abisara tyrannus, GROSE SMITH and KIRBY, Rhop. Ex. II, t. Dic. and Ab. I, f. 7, 8, ♂, 9, ♀ (Waigoe); id., FRUHSTORFER Iris 1904, p. 145; *Praetaxila tyrannus*, FRUHSTORFER in SEITZ X, 1914, p. 795, t. 140f (Waigoe and Neth. New Guinea); *Sospita tyrannus*, STICHEL, ls. cs.

a. *S. tyrannus tyrannus* GR. SM. and K. 1897.

Waigeo (holotype and allotype in coll. STAUDINGER, Mus. Berlin).

b. *S. tyrannus segestes* ROTHSC. 1904

Abisara segestes, ROTHSCCHILD, Nov. Zool. XI, 1904, p. 455 (♂, E. of Geelvink Bay); (*Praetaxila tyrannus segestes* JORD. (sic !), FRUHSTORFER in SEITZ, l.c.; *P. tyrannus segestes* ROTHSC; JOICEY and TALBOT, Bull. Hill Mus. I, p. 334 (♂ and ♀, Wanggaar R., S. of Geelvink Bay, Neth. N. W. New Guinea); *Sospita tyrannus segestes*, STICHEL, ls. cs.

1 ♂, Bernhard Camp, Idenburg R., 50 m, 3. VIII. 1938; 6 ♀♀, ib., VII—VIII. 1938 and 13. IV. 1939.

♂ Corresponds entirely to ROTHSCCHILD's diagnosis but not to the picture of ROTHSCCHILD's type in "SEITZ", which shows a yellowish patch in interspace 6 that ROTHSCCHILD did not mention in his description (he spoke of "a small white marginal dot at apex"). FRUHSTORFER, however, adduced this as a point of difference with *tyrannus* ("differiert von *tyrannus*-♂ durch das Vorhandensein eines weissen Punktes des Vorderflügels"). Since ROTHSCCHILD never neglected an important detail, it is obvious that the yellowish discal point of the picture should be regarded as an artefact. On the other hand FRUHSTORFER omitted to draw attention to the important fact that *segestes* ♂ lacks the tawny lining of the distal part of some median and submedian veins of the hindwings.

♀ JOICEY and TALBOT's description of *segestes* ♀, based on three specimens ¹⁾ caught at Wanggaar R., in the extreme S. of Geelvink Bay (600-2000', leg. Messrs. PRATT) is quite applicable to our series from Idenburg R. This sex differs from typical *tyrannus*-♀ by a reduction of the white postdiscal spot of the forewing above and by the absence of any yellow or tawny colour below. Three out of our six specimens have the white discal spot in interspace 2 of the upperside reaching to the submedian fold, in one specimen it just reaches below vein 2, with the two others it stops at vein 2. The cell spotting is also due to much variation.

1 ♂ and 4 ♀♀ in Museum Buitenzorg; 2 ♀♀ in the National Museum, New York.

c. *S. tyrannus polyphemus* n. subsp.

1 ♂, Cycloop Mts., W. of Hollandia, 400 m, 28. VI. 1938 (OLTHOF).

♂ *Upperside*: differs from *segestes*-♂ (Bernhard Camp specimen) in the orange band having projecting teeth at veins 2-5 and extending broadly to the submedian fold; the orange colour is of a lighter shade. *Underside*: cell-bar 1 mm broad (in my *segestes* specimen 2 mm), discal fascia widens towards vein 2 and then tapers again but does not (as in typical *tyrannus*) bend towards the cell at its upper end nor towards the base at its lower end. The large tawny-white basal-costal triangular patch of the hindwing is reduced and keeps at 2 mm distance from the outer and lower cell-edges; the trapezoidal dorsal patch is whiter and smaller,

1) The authors record four specimens in the text but summarize only three in their locality list.

but is prolonged along dorsum to the series of three white square patches below (which are reduced to two linear bars in *segestes* and *tyrannus*). Disc dark brown devoid of tawny intervenal stripes or suffusion. Submarginal white bars broader than in *segestes* (where these are thin lines).

Holotype (unique) in Museum Buitenzorg.

With this fine discovery by my assistant Mr. JAN OLTIOF the known range of the "exceedingly rare species" *tyrannus* had been extended another hundred and twenty miles to the east. Its discovery in Vogelkop Peninsula and other districts of N. New Guinea will only be a question of thorough research.

I recommend to future students to investigate the relationship of *S. albiplaga* RÖB. and *tyrannus* GR. SM., as the former may happen to be the northern representative of the latter. The differences, though obvious enough, merely consist of an augmented amount of orange colour at the hindwing tornus above and below (onymotypical *tyrannus* shows orange veins in this part) and the (more essential) dislocation of the white discal spot of the female forewing.

10. *Sospita heterisa* JORD. 1912.

Abisara heterisa, JORDAN, Nov. Zool. XVIII, 1911-12, p. 596 (Mt. Goliath, at head of Eilanden R., Neth. Central New Guinea); *Praetaxila heterisa* JORD., FRUHSTORFER in SEITZ IX, 1914, p. 796; *Sospita heterisa* JORD., STICHEL ls. cs.

This species is known from Mt. Goliath in Central New Guinea a hundred miles W. of the British frontier, to Arfak Mts. in the Vogelkop Pen.

It was never found in the British territory, where it seems to be represented by a near relative, *S. weiskei* ROTHs. (1901), which, however, is white-banded on the forewing upperside in both sexes, and a ♀ with a grey-brown in stead of an orange hindwing.

The ARCHBOLD Expedition produced a subspecies of it from near Idenburg R., which differs in some respects from the onymotypical form, whereas dr. BOSCHMA of the LE ROUX Expedition brought home a nearly related form from Wissel Lakes.

The Arfak representative, *tessei* JOIC. and NOAKES (1915) stands quite apart, differing from *heterisa*, though in other points, nearly as much as *weiskei* does.

The main differences between *tessei* and *heterisa* are: the orange colour of the *heterisa* hindwing is chestnut in *tessei* ¹⁾; the submarginal series of spots of the hindwing both above and below is nearer to the margin in *tessei* and the spots are flattened, the discal row of brown spots is much dislocated there instead of continuous; the white subapical spots on the forewing of the ♂ are contracted towards the costa and are there-

1) This colour is very badly represented on the original plate (f. 4, left side), and in the explanation the species is called *Praetaxila*, whereas the text says *Abisara*.

fore situated in other interspaces than with *heterisa*.

S. weiskei, *S. heterisa* and *S. tessei* might, after all, still be modified forms of one species only, though each of them has developed minor local variations ¹⁾.

We will now expose the differential characters of the members of the *heterisa* group (*sensu stricto*), and therefore exclude *tessei* JOIC. and NOAKES.

a. *S. heterisa heterisa* JORD. 1912
Mt. Goliath.

b. *S. heterisa sigiana* n. subsp.

1 ♂, Sigi Camp, 1500 m, 19.II; 5 ♀♀, Sigi Camp, 21, 24, 26.II. Lower Mist Camp, 1500 m, 20.I, Top Camp, 2100 m, 9.II. 1939.

Differs in the ♂ sex from *S. heterisa heterisa* in the discal crenulated fascia of the hindwing underside not being whitish, but purplish-grey, and the upper three spots of the white submarginal markings are linear.

♂ *Upperside*: forewing orange fascia of about 1 mm width, rather continuous (the gaps at veins 3 and 4 are small), the last streak is long and thin; basal third dark chestnut brown, this colour is produced along the dorsum to the tornal angle, getting lighter in its exterior half (but not changing to orange); three white subapical spots are present, the one in 6 oval and largest. Fringe black. Hindwing with basal third dark chestnut-brown, apical third black and tornal third orange. The edge between black and orange runs from margin at tip of 5, involving a submarginal spot in interspace 4, to a diffuse elongated discal spot in 3, thence curves round the upper part of the cell, keeping some distance from it; basal-costal portion whitish. There is a second diffuse black spot of the discal series, small, round, at the edge of orange and brown, in interspace 2. The brown part is quickly covered with bay hairs, turning into light buff towards dorsum. The submarginal series consists of three round black spots, that in 3 being largest and of about 2 mm diameter, the lowest one a minute dot.

Underside: burnt umber colour, basally lighter. Spot in cell separated from bar at end of cell (both barely visible against the dark ground) by a 1 mm broad greyish bar; whitish oblique fascia pure white at costa, other parts sordid, the orange colour from above being somewhat shining through; submarginal fascia above vein 3 moniliform, lower part dirty orange with a white point on the fold in interspace 2. Hindwing with a series of 6 black submarginal spots, increasing in width from tornus to apex, the costal one of about 3 mm width, the four lower ones completely ringed with white, the thickest part of these rings being about 1 mm; admarginal orange area reaches from tornus (where it is broadest) to near

1) *Sospita weiskei huonis* JORD. 1930 (pro *Praetaxila w. h.*: Nov. Zool. XXXV, 1930, p. 282; id., Proc. Ent. Soc. London V, p. 60) inhabits Herzog Mts., near Huon Gulf, in „German“ New Guinea.

apex, this colour fills the gaps between spots 2 to 5 and spreads over the fringe up to 5 but interrupted at vein tips 2, 3 and 4. There is a minute white submarginal dot in interspace 1b.

♀ *Above* like ♂ but somewhat larger and with rounder wings. Basal parts maroon with an indefinite chestnut-brown edge. Oblique fascia of forewing 2.5 to 3 mm broad; there are sometimes one or two minute white dots above the upper white subapical spot. Hindwing as with the ♂.

Underside: like *heterisa* typical but white submarginal fascia moniliform as in the ♂; hindwing: white rings round the six black spots (which are larger than in ♂) incomplete, the upper white submarginal streak is often absent; the black vein tip dots much larger, the fringe between the upper ones assumes a white edge.

Length of ♂ forewing 29 mm; of ♀ 29-31 mm, average 30 mm.

Holotype: ♂ (unique); allotype (Sigi Camp 26.11) and 3 ♀ paratypes in Museum Buitenzorg; 1 ♀ paratype in American Museum of Natural History, New York.

With the exception of the holotype and allotype, which are in perfect condition, all specimens are rather damaged. The Top Camp specimen is doubtlessly a stray. On sunny days butterflies are often seen ascending mountain slopes, and the most unexpected lowland things may then happen to come before the net.

There is very little variation in the series of ♀♀.

This species is very quick on the wing and difficult to catch thanks to its alertness. I observed a ♂ during three days in succession visiting the same group of leaves to bask in the afternoon sun, each time at the same hour, but I did not manage to get within reach of it, though it was well accessible.

c. *S. heterisa auspex* n. subsp.

4 ♂♂, Lake Paniai, Wissel Lakes, 1700 m, 22. VIII, 16. IX and 14. XI. 1939; Araboe R., 1750 m, 1. XI. 1939; 3 ♀♀, Lake Paniai, 7 and 13. IX and 19. XI. 1939 (H. BOSCHMA).

Near to *S. heterisa sigiana* but the orange fascia on forewing is wider (and in the ♂ sex more interrupted); there is a clear orange subternal spot; the orange part of the hindwing is more expanded above together with a reduction of the black submarginal spotting; the white submarginal fascia on the forewing below is broader and consists of linear elements (no head-like spots); the white rings on the hindwings are considerably broader and the black vein tip dots are also magnified below.

♂. *Upperside*: orange oblique fascia of 1.5 to 2 mm width, broadly interrupted at veins 3 and 4; a diffuse orange spot astride of vein 1 at 3 mm from tornus, gradually merging into the dark chestnut-brown basal third; fringe black with white dots between the veins. Hindwing: apical continuous black part restricted to the area above vein 4, with a tiny interior spot in interspace 3; the submarginal series consists of one well-developed black spot in 3 and sometimes a vestigial black spot in 2, that of 1c always reduced to total absence; black vein tip dots well-developed and very conspicuous, this also being due to the orange colour being somewhat brighter than with the *sigiana*-♂.

Underside: forewing, light cell-bar dirty white and generally more than 1 mm broad; oblique fascia of about 2 mm width, submarginal white fascia consisting of white bars, 1 to 1.5 mm broad, between the veins down to vein 3, thence of a thin orange line down to nearly vein 1. Hindwing somewhat lighter than in *sigiana*-♂, and markings therefore getting better pronounced;

the shady greyish margins of the cell-spot and the discal series broader and lighter, the white rings much broader at the cost of some of the black central spots that look as though they were reduced and flattened: the black vein tip dots are conjoined by a grey admarginal line, which is broad between 2 and narrow between 3 and 4 (with *sigiana* this line is vestigial between 2 and 3 and further absent).

♀. *Upperside*: similar to the *sigiana*—♀ but for the same differences that are obvious in the other sex. Orange fascia 3 to 4 mm broad above; orange streak near tornus about 3 mm wide and reaching to nearly mid-dorsum; a dusky brownish dot between lower spot of fascia and tornal orange streak; two small white dots above the subapical series, the spots of which are superior in size to those of *sigiana* (in one specimen a white dot in interspace 3 lengthens the series); hindwing likewise with expanded orange area which invades the basal part of interspace 4 as a triangular spot; the submarginal series consists of a semidetached black spot in 4 and a round spot in 3, the spot in 2 of *sigiana* being completely vanished.

Underside: forewing with a lighter basal part than in *sigiana* especially within the cell; fascia wider conform to that change in the ♂ sex; hindwing with lower submarginal spots completely or nearly completely white-encircled; a well-developed white spot at 2/3 of tornus in interspace 1b; internal brown caps of white rings in 1b, 2 and 3 smaller than in *sigiana*—♀.

Length of ♂ forewing 28, 29, 30 and 30 mm, average 29.2 mm; that of ♀ 29, 31 and 33 mm, average 31 mm.

Holotype: ♂ (22. VIII), allotype (13. IX) and 3♂ and 2♀ paratypes provisionally in the Buitenzorg Museum.

This subspecies, though geographically rather near to *S. tessei* from Arfak Mts. (240 miles as the crow flies) is genealogically much nearer to the *heterisa* type from Mt. Goliath though that distance is even wider.

Dr. STICHEL treated *S. tessei* as a subspecies of *heterisa*, but now that we know of two geographical links the position of the former has become a more isolated one, for these so-called links widen the gap in stead of filling it up. This proves again that Vogelkop mountain insects though related may have developed to such a specialized form that in many cases it will be better to consider them separate valid species. TALBOT, in his *Delias* monography, estimated most of the Arfak *Delias* as such, although the close relationship to Snow Mts. forms is just as obvious as with our insect. To draw the line here seems very difficult, but this course seems well practicable at the time being. I am, however, disposed to accept the opinion that a closer examination of the structure details of the three mountain *Sospita*'s from New Guinea (*tessei*, *heterisa*, and *weiskei*) most probably will bring forth their unification to one species again.

11. *Sospita satraps* GR. SM. 1894

Abisara satraps, GROSE SMITH, Nov. Zool. I, 1894, p. 545 (Humboldt Bay); id., GROSE SMITH and KIRBY, Rhop. Ex. II, 1897, t. Dic. and *Abis.* I, f. 10, 11, ♂, 12. ♀; p. 4; *Praetaxila satraps* GR. SM., FRUHSTORFER in SEITZ IX, 1914, p. 795; *Sospita satraps* GR. SM., STICHEL, ls. cs.

Known from Wandammen Mts. (?), Geelvink Bay, along the North Coast to Mambare R. (Brit. New Guinea).

a. *S. satraps satraps* GR. SM. 1894

Abisara satraps, GROSE SMITH, l.c. (Humboldt Bay); id., GROSE SMITH and KIRBY, l.c.; id., ROTHSCHILD, Nov. Zool. XI, 1904, p. 455 (Dutch New Guinea, probably E. of Geelvink Bay); *Abisara satraps satraps* GR. SM., FRUHSTORFER, Iris 1904, p. 145; *Praetaxila satraps satraps* GR. SM., id. in SEITZ IX, 1914, p. 795; *Praetaxila satraps* GR. SM., VAN EECKE, Nova Guinea XV, 1924, Zool., p. 40 (Mamberamo R. and Idenburg R.); *Sospita satraps satraps* GR. SM., STICHEL, ls. cs.

2 ♂♂, Bernhard Camp, Idenburg R. 50 m, 20. VII, 12. VIII. 1938; 5 ♀♀, Hollandia. Humboldt B., VII. 1938; 1 ♀, Bernhard Camp, 15. IX. 1938.

Also 2 old ♀ specimens in the Buitenzorg Museum, Prauwenbivak, Idenburg R., XI. 1920 (leg. W.C. VAN HEURN, det. VAN EECKE).

Length of ♂ forewing 27, 29 mm, average 28 mm; that of ♀ 27-30 mm, average 28.7 mm.

1 ♂ and 2 ♀♀ of the ARCHBOLD Expedition Collection have been sent to the American Museum of Natural History, New York; the other specimens are in the possession of the Buitenzorg Museum.

The ♀ form of GROSE SMITH's description and figure in Rhop. Ex. seems to be not the most abundant one. In fact, there is only one lowland ♀ specimen in our collection that entirely corresponds to that, whereas seven out of eight differ in one way or other. That one specimen has the white disc of the hindwing above connected with two spots of the submarginal series. One specimen, taken from VAN HEURN's Prauwen-Bivak collection, has a hindwing white discal patch with one projecting tooth that reaches to the third white spot of the submarginal series. With all others the white disc keeps some mm distance off that series. The latter may consist of four spots (as in the typical form), or three (as in the majority of my series) or even of none at all (in one specimen). Correspondingly the forewing submarginal series consists of six to three white dots of very variable size. The oblique fascia generally is continuous from subcosta to vein 2, but in one specimen it consists of three detached streaks (the central one is rather a spot) of 1 mm width only. In the specimen with the broadest fascia it fully measures 4 mm and all intergrades are to be observed.

The underside basal cell-streak may be clear white, or grey or even obsolescent; the white cell-bar broad and square, or luniform, or a short thin line or dot. The submarginal orange marks may be reduced to short streaks on the veins, varying to maximally a rather continuous filling of the room between all the separate black spots.

There is, however, one characteristic that seems to be constant in this lowland form: the submarginal series of the forewing below consists of five sharply defined white spots followed by two small others which may be conjoined by a diffuse orange streak.

In view of these facts it must be judged exceedingly difficult to delineate subspecific characters because the internal variation exceeds the normal interspecific one. Amongst my series the specimen with the narrow detached spots would have been identified as *mambarensis* if no label had told its true locality.

Other specimens with reduced hindwing submarginal spots could be mistaken for *S. postalba* ROTHs. and JORD., the more triangular, less rounded wing form of the latter being the only easy distinguishing characteristic at hand. It is with much hesitation that I have identified a series of ♀ specimens from our upper camps to belong to *postalba* and some others to *satraps*.

Others have had the same troubles. JOICEY and TALBOT described *Praetaxila postalba wandammenensis* from Wandammen Mts. S. of Geelvink Bay, which STICHEL enlisted in *S. satraps* as a 'forma' of the typical subspecies, but I am at a loss on the strength of the arguments, not having been able to study the literature concerning that question. I am, however, convinced that it has to be carefully re-investigated, because the species *postalba* doubtlessly also inhabits those parts, which I have had the pleasure to test when seeing the JURRIAANSE collection of the Leiden Museum which contains an unmistakable ♂ *postalba* from Roon I., which island constitutes a kind of headland to Wandammen Pen.

The great variability of *S. satraps*- ♀ may be connected to its being a mimic. The models are *Nymphalidae* of the *Neptis* group being imitated by several other butterflies. It is a well-known rule that where and when mimicry interferes with the evolution the resemblance of the mimic is liable to a great deal of fluctuation.

b. *S. satraps cyrus* n. subsp.

2 ♂♂, Lower Mist Camp, 1450 m, -31. I and Araucaria Camp, 800 m, 2. III. 1939; 1 ♀, ibid., 10. III. 1939.

♂ *Upperside*: differs from *satraps* typical in having a thin orange edge to the chestnut area of the forewing, running from the tornus upwards to vein 4, and the chestnut basal area of the hindwing slightly restricted.

Underside: both forewing fasciae show some whitish spots, especially at costa and at the crossings with the intervenal folds; near tornus some orange scaling is just traceable. Hindwing, cell-spots and discal greyish dots brown-grey, obsolescent.

♀ Not obviously different from some of our lowland specimens.

Length of ♂ forewing 29 mm, that of ♀ 29.5 mm.

Holotype, ♂ (Lower Mist Camp specimen), allotype and 1 ♂ paratype in Museum Buitenzorg.

There is further one aberrant ♀ specimen from Araucaria Camp amongst our captures, which although it looks rather fresh, has a pallid grey, bleached appearance. I caught it myself in this state and think we have to do here with a thinly scaled variety; I think it unnecessary and unwise, however, to name such varieties. It is labelled: Araucaria Camp, 800 m, 2. IV. 1939, and preserved in the Buitenzorg Museum.

The occurrence of the lowland species *S. satraps* at 1450 m is another instance of the phenomenon we repeatedly observed in the sheltered, eastward-opening valleys of the mountain massive S. of Idenburg R. For further particulars see sub *Dicallaneura decorata*.

12. *Sospita postalba* ROTHs. and JORD. 1907

Abisara postalba, ROTHsCHILD and JORDAN, Iris 1907, p. 192 (Upper Mambare R., Brit. N. New Guinea); id., JORDAN, Nov. Zool. XV, 1908, p. 253, t. 11, f. 7. ♂, 8, ♀; *Praetaxila postalba* ROTHs. and JORDAN, FRUHSTORFER in SEITZ IX, 1914, p. 794, t. 140 f. ♂, g. ♀; *Sospita postalba* ROTHs. and JORD., STICHEL, ls. cs.

Known from Mambare R., and Geelvink Bay (Wandammen Pen. and Roon I.).

a. *S. postalba postalba* ROTHs. and JORD. 1907

Upper Mambare R.

b. *S. postalba wandammenensis* JOIC. and TALB. 1916

Praetaxila postalba wandammenensis, JOICEY and TALBOT, Ann. Mag. Nat. Hist. 1916, p. 77,

t. V. f. 6 (Wandammen Mts.); *Sospita satraps satraps* forma *wandammenensis* JOIC. and TALB., STICHEL, in Tierreich, 1928, p. 127; id., in Lep. Cat. 1930, p. 121.

Wandammen Mts., Roon I. (Mus. Leiden).

c. *S. postalba artaxerxes* n. subsp.

7 ♀♀, Mountain Slope above Bernhard Camp, 600 m. 5. II; Araucaria Camp, 800 m. 12 and 25. III, 2. IV; Sigi Camp, 1350 and 1500 m, 20 and 28. II. 1939.

♀ Strikingly similar to *satraps*- ♀ and *cyrus*- ♀; differs mainly in the straighter termen ¹⁾, the larger size and the fainter submarginal spotting of the forewing underside.

Upperside: forewing subtriangular, dark brown with a very faint purple gloss in some lights, markings like *satraps* typical; three or four well-developed subapical-marginal white spots, decreasing in width from apex downwards, rarely an extra dot above this series near the costa. Hindwing identical to *satraps*, the white disc may be elongated or reduced, the number of submarginal spots varying from three to none at all; some orange suffusion may be seen near apex.

Underside: similar to *satraps* typical, differs in the oblique fascia and submarginal spots of forewing being situated on a pallid ground, which causes the edges to look diffuse. Hindwing with three subcostal dark brown blotches as with *satraps*, but at the inner side of the third blotch there is a brown streak attached to it in two specimens ²⁾ protruding into interspace 4 and keeping some distance off the celledge; orange lining of black submarginal spots as variable as with *satraps*, sometimes restricted to a small area near apex and to some faint vein dots.

Length of forewing: 30, 30, 31, 31, 31, 32, 32 mm, average 31.0 mm.

Holotype (Araucaria Camp 2. IV) and 4 paratypes in Museum Buitenzorg; 2 other paratypes in the American Museum of Natural History, New York.

All specimens were more or less damaged and the majority rather old.

As I had no access to specimens or literature of *S. postalba wandammenensis* JOIC. and TALB. it may happen that my name *artaxerxes* will drop before theirs, but most probably not, because the differences between Wandammen Mts. insects and conspecific ones from the hinterland of Idenburg R. are manifest in most cases.

1) If the costa = \bar{a} and the dorsum = \bar{b} , the value of $\bar{a} : (\bar{a} - \bar{b})$ pendulates round 5 in *satraps* but round 4 in *postalba*- ♀; this proves that the dorsum is relatively longer in *satraps*.

2) In holotype and the Sigi Camp 1500 m specimen. A trace of this typical *postalba* stripe (see original description and the picture of the ♀ in Nov. Zool. XV) is observed in the aberrant ♀ of *satraps cyrus* quoted above.

SUMMARY BY EDITOR

The Butterfly family of *Riodinidae* is well represented in the fauna of New Guinea. There are two genera, *Sospita* Hew. (= *Praetaxila* FRUHST.) and *Dicallaneura* BTL., which are restricted to the mainland and the adjacent islands, with the exception of one species of *Sospita* having reached North Queensland.

The total number of species known to inhabit the mainland and environments was twenty-four up to now, and three new species are added to the list in the present paper.

Most species of butterflies show considerable differences in connection with the localities they inhabit, and this is more obvious with rare species than with the common ones. The *Riodinidae* may be counted among the former, and consequently display a great deal of local variation. Even on the mainland of New Guinea many subspecies are to be observed. This paper contains descriptions of four new subspecies of *Dicallaneura* and five new subspecies of *Sospita*.

Some information on the behaviours of the New Guinea *Riodinidae* are given, but the early stages of them are still unknown.

Besides the material of the Archbold Expedition, which was collected between Hollandia and Mt. Wilhelmina, the author had access to the old stock of the Buitenzorg Museum, and to the fresh acquisitions due to the LE ROUX Expedition to the Wissel Lakes and the travels of Mr. LUNDQUIST in S.W. New Guinea. The specimens in the author's private collection were also studied as a matter of course.

The commonest and best known species, *Dicallaneura decorata* HEW. is discussed at some length, because it shows a series of phenomena which are usual in New Guinea lowland butterflies and which are attributed by the author to the geological changes the island had to endure in the course of time. One of the most striking discoveries of this expedition was the finding of aggregations of lowland species in sheltered mountain valleys deep inland, and a *decorata* subspecies being found on the Araucaria River banks yielded further proof of the existence of initial endemisms.

The high-mountain *Dicallaneura*'s are very difficult to identify, therefore a key is given to discriminate them, and owing to the sexual dimorphism, this was necessary for both sexes separately.

The genus *Sospita* counts mostly species of moderate altitudes, and is remarkable because some of its members were exclusively found North, and others only South of the Snow Mountain Range. There are three

mountain dwellers known: *S. weiskei*, *S. heterisa* and *S. tessei*, but these inhabit separate regions, and it is thought possible that they are vicariating species, or in other words, that they have developed from one ancestral stock.

Sospita satraps GR. SM. produces a second example of the development of separate subspecific forms of lowland species occurring in the mountain massive S. of Idenburg River. There is another species, however, *S. postalba* R. & J., which can easily be confused with it in the female sex. Differential points are given in the various descriptions.

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